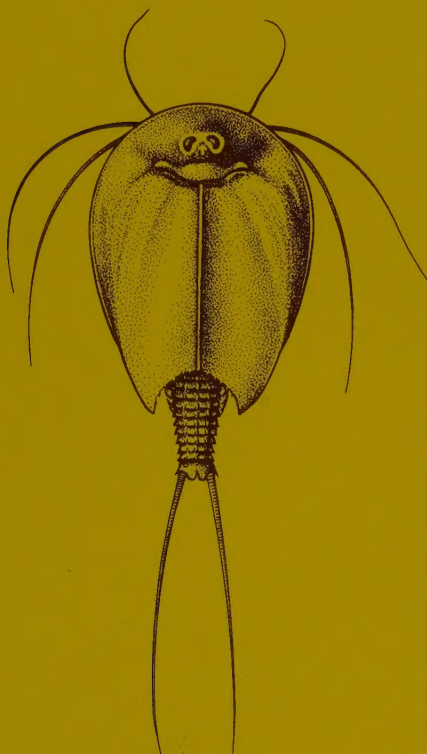


FAUNA OF SAUDI ARABIA

VOL. 15 1996



Patron:

H.R.H. Prince Saud Al-Faisal

Editors:

Friedhelm Krupp

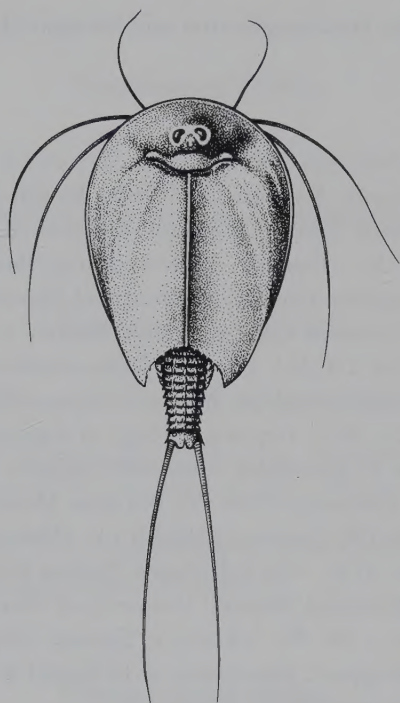
Volker Mahnert

National Commission for Wildlife Conservation and Development
(NCWCD) Riyadh, Saudi Arabia

Pro Entomologia c/o Natural History Museum, Basle, Switzerland

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Triops cancriformis (Bosc, 1801)

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ISBN 3-7234 0015 9

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Distributors: Karger Libri AG, Petersgraben 31, CH - 4009 Basle, Switzerland.

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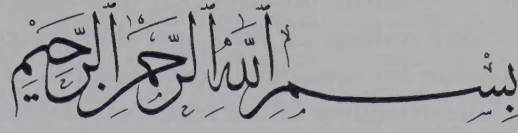
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PREFACE

H.R.H. Prince Saud bin Faisal bin Abdul Aziz
The Managing Director

Arabia's position at the junction of three major zoogeographical realms, its recent geological past and the great variety of its landscapes and climates is reflected in a complex natural history and a rich and varied wildlife. Systematic investigations into its biological diversity started only two decades ago when, in 1975, Professor William Büttiker initiated the Zoological Survey of Saudi Arabia triggering a multitude of biological research activities in a region which previously harboured one of the world's least known faunas. A wealth of basic scientific information on the taxonomy, faunistics, zoogeography and ecology of the region's wildlife became available which was a prerequisite for both a sustainable exploitation of Arabia's renewable natural resources and for appropriate nature conservation initiatives.

In Saudi Arabia the conservation of nature has a long tradition. The Islamic view of the environment takes a holistic, ecological form. It clearly defines the relationship between man and his environment, and the interaction of both with regard to development, utilisation and conservation of renewable resources. With the ever increasing speed of modern development, natural resources such as water, range lands, woodlands and wildlife are becoming progressively more scarce. In the light of these changes, traditional institutions such as the hima (protected area) receive renewed relevance and importance. In conjunction with the results of modern zoological research they form the basis of a regional strategy for sustainable development and the conservation of natural resources.

Over the past 16 years, "Fauna of Saudi Arabia" has been instrumental in promoting these goals. With the publication of volume 15, "Fauna of Saudi Arabia" has again reached a historic landmark. Professor Büttiker, the senior Editor who founded the series in 1979 together with Dr. Walter Wittmer, has decided to hand over his duties to younger colleagues. On behalf of the National Commission for Wildlife Conservation and Development, I would like to express our sincere gratitude and deep respect for his outstanding contribution to the study and conservation of Arabian wildlife. He has set the standards for the future. Finally, I wish every success to the new editorial team, it will be a challenging and demanding task for them to follow in Professor William Büttiker's footsteps.

INTRODUCTION

Arabia is passing through a period of rapid change. Regional authorities, in their development plans, endeavour to avoid the unfortunate mistakes that have been made in other parts of the world. Professor William Büttiker realised 20 years ago, that protecting Arabia's environment would be an essential prerequisite for sustainable development of the Peninsula's renewable resources. However, a deeper understanding of the region's biological diversity was required for serious nature conservation. As a consequence, he initiated the Zoological Survey of Saudi Arabia and four years later founded a series of books "Fauna of Saudi Arabia" for the publication of the scientific results. This year, at the age of 74, he has decided to entrust us with the editing of the series and to devote his time to other important scientific activities.

William Büttiker may look back on a distinguished scientific career and on achievements which are unique in the history of biological research in Arabia. After earning his M.Sc. and Ph.D. at the Swiss Federal Institute of Technology, Zürich, he spent most of his life abroad. Between 1948 and 1975 he worked as an expert on insect pest control and public hygiene with Pest Control Ltd., UK., the World Health Organisation (WHO) of the United Nations and Ciba-Geigy Ltd. in many parts of Africa, Asia, America and Europe. He came to Saudi Arabia in 1975 as a Ciba-Geigy research scientist. In the same year he initiated the Zoological Survey which, in the beginning, focused on insects and other arthropods of medical, veterinary and agricultural importance. However, the scope of this long-term project soon expanded to include general taxonomy, faunistics, zoogeography and the ecology of terrestrial, freshwater and marine animals, establishing the baseline for an animal species inventory of Saudi Arabia and neighbouring countries.

The Zoological Survey, which was a new approach to biological research in the Peninsula, produced a wealth of interesting and important scientific results for use in nature conservation projects. An appropriate vehicle for their publication was now needed and Prof. Büttiker, in conjunction with Dr. Walter Wittmer of Pro Entomologia from the Basle Natural History Museum, founded the series "Fauna of Saudi Arabia". The first two volumes were published jointly by Pro Entomologia and Ciba-Geigy Ltd., Basle, in 1979 and 1980. In the Introduction to volume 1 the Editors stated, "It is anticipated that a series of four or five volumes will be published at more or less regular intervals within the next ten years".

After his retirement from Ciba-Geigy Ltd. in 1981, William Büttiker worked for the Meteorology and Environmental Protection Administration (MEPA), Jeddah, as a Consultant in Environmental Science. Thanks to the initiative of H.E. Dr. A. Al-Gain and Prof. A. Banaja, MEPA cosponsored the publication from volume 3 and altogether six volumes were published under the their patronage. The idea of producing a continuous series on the wildlife of Arabia was now born. Despite its title "Fauna of Saudi Arabia", the series now covers the entire Peninsula, a subcontinent almost as large as India, and its surrounding seas. After the publication of volume 5, Walter Wittmer retired from his position as Curator of Entomology at the Basle Natural History Museum and as editor of "Fauna of Saudi Arabia". In April 1984, Friedhelm Krupp joined Professor Büttiker as Co-editor of the series.

In 1986, Saudi Arabia's National Commission for Wildlife Conservation and Development (NCWCD), Riyadh, was founded by Royal Decree and given the mandate for the study and conservation of Saudi Arabia's biological diversity. One year later Professor Büttiker joined the NCWCD which then took over the publication of "Fauna of Saudi Arabia" so that, as of volume 9, the series was jointly produced by Pro Entomologia and NCWCD. When in 1990 an index to the first ten volumes was produced, "Fauna of Saudi Arabia" already had more than 200 contributors,

eminent scientists from all over the world who had conducted research on the fauna of Arabia. Between 1979 and 1989 no less than 789 taxa - genera, species and subspecies - were introduced as new to science of which 54 have been named after William Büttiker in appreciation of his outstanding contribution to the study of Arabian biodiversity.

In many respects Prof. Büttiker, who throughout his career relied upon the enthusiastic and active assistance of his wife Sonja, is a pioneer in the zoological exploration of the Arabian subcontinent. While he conducted the Zoological Survey, Faculties of Science and Biology Departments were founded at several universities in Saudi Arabia and neighbouring countries. As a part of his effort to involve Saudi scientists in the activities of the Zoological Survey, he lectured at King Saud University in Riyadh and King Abdulaziz University in Jeddah and trained post-graduates in ecology and environmental protection. As a direct result, an increasing number of Arabian zoologists are now contributing to the "Fauna of Saudi Arabia". During his employment with MEPA and NCWCD, William Büttiker also developed public awareness programmes and suggested the establishment of forty protected areas, several of which have now been established.

As of volume 15, Dr. Volker Mahnert, Director of the Natural History Museum at Geneva, whom many readers will already know as the expert on Arabian Pseudoscorpiones, becomes Co-editor of "Fauna of Saudi Arabia". Professor Büttiker will continue to play an active role in the production of the series, even after his retirement, both as an advisor and as a research scientist. It is our pleasure to thank him for his substantial contribution towards the production of this present volume.

Finally, we would again like to express our sincere gratitude to our Patron, H.R.H. Prince Saud Al-Faisal for his continuous support. Our sincere appreciation is also due to the National Commission for Wildlife Conservation and Development, Riyadh, and in particular to its Secretary General, H.E. Prof. Dr. Abdulaziz H. Abuzinada. Once again Prof. Dr. Iyad A. Nader, Wildlife Expert at the NCWCD, took a very active role in the production of this volume. We wish to convey our thanks to the Principal Advisors and to the members of the Advisory Board, the referees, the Directors and the staff of the Senckenberg Research Institute and Natural History Museum and the Basle Natural History Museum, in particular Dr. Michel Brancucci.

Dr. Anne Newton and Mr. Roderick M. Fleming corrected the English and Prof. I.A. Nader and Mrs. Huda Hajjar At-Tayyeb translated the Abstracts into Arabic. Ms. Eva Feltkamp and Dr. A. Newton were in charge of the technical editing. Our sincere thanks are due to all authors and collaborators for their participation in the production of the present volume.

Frankfurt and Geneva, September 1995

The Editors

On some Spider Mites (Acari: Tetranychidae) of Yemen

Magdalena K.P. Smith Meyer

Abstract: Fourteen species of spider mites are recognised and distinguished in a key. The following five new species are described and illustrated: *Neopetrobia harteni*, *Sonotetranychus wadicolus*, *Mononychellus yemensis*, *Eotetranychus belus* and *Tetranychus adensis*.

بعض أنواع الحلم العنكبوتي (رتبة الأكاروس : عائلة العنكبوت الأحمر) من اليمن

بمجلدنا. ك. ب. سميث ماير

خلاصة : يتضمن هذا البحث تسجيلاً لـ ١٤ نوعاً من الحلم العنكبوتي تم التعرف عليها وتمييزها بمفتاح تصنيفي. كما تم وصف ورسم الأنواع الخمسة التالية كأنواع جديدة للعلم: *Mononychellus* و *Neopetrobia harteni* و *Sonotetranychus wadicolus* و *Eotetranychus belus* و *Tetranychus adensis*.

INTRODUCTION

The Tetranychidae, or spider mites, are among the most important plant pests. Previous information concerning the spider mite fauna of Yemen is given by SOLIMAN & MAHFOOD (1975 [1977]) and SMILEY & BAKER (1995).

This paper deals with part of the collection of mites made by Mr. Antonius van Harten and Mr. Markus Knapp who are engaged in the Yemeni-German Plant Protection Project. Fourteen tetranychid species are recognised and of these five new species are described and habitus figures are presented. Notes on the distribution of the known species, the agricultural crops they attack and the feeding injuries they cause are given.

The type material of the newly described species and the non-type material have been preserved as slide-mounted specimens and deposited in the National Collection of Arachnida, Plant Protection Research Institute, Agricultural Research Council, Pretoria, South Africa.

The terminology for the dorsal body setae, as used in the descriptions of the species, is according to LINDQUIST (1985). All measurements are given in micrometres (µm).

Key to some tetranychid species from Yemen

- | | | |
|---|--------------------------------------------------------------------------------------------------------------------------------------------------|---|
| 1 | Empodium with tenent hairs; female with three pairs of anal setae and male with five pairs of genito-anal setae (subfamily Bryobiinae) | 2 |
|---|--------------------------------------------------------------------------------------------------------------------------------------------------|---|

- Empodium without tenent hairs or empodium may be absent; female with one or two pairs of anal setae and male with three or four pairs of genito-anal setae (subfamily Tetranychinae) 6
- 2 Prodorsum with setiferous projections or lobes anteriorly; opisthosoma with fourth pair of dorsocentral setae (f_1) marginal or more widely spaced than preceding three pairs of dorsocentrals (genus *Bryobia*) 3
- Prodorsum without setiferous projections anteriorly; opisthosoma with fourth pair of dorsocentral setae (f_1) in dorsal position, not more widely spaced than preceding three pairs of dorsocentrals 5
- 3 True claws of leg I uncinat; empodium I with one pair of tenent hairs; female prodorsum with four setiferous projections 4
- True claws of leg I straight (Fig. 6); empodium I with about four pairs of tenent hairs; female prodorsum with three setiferous projections, medial pair fused, lateral projections weakly developed (Fig. 3) *Bryobia tuttleri*
- 4 Prodorsal projections of female mostly with spine-like outgrowths; female genu II with five setae; tactile setae on tarsus IV distal to and well separated from solenidion; peritremal enlargement about 2.5 times as long as broad *Bryobia rubrioculus*
- Prodorsal projections of female without spine-like outgrowths; female with genu II with six setae; solenidion on tarsus IV associated with a tactile seta, forming a duplex set; peritremal enlargement about four times as long as broad *Bryobia praetiosa*
- 5 True claws and empodia pad-like; dorsal body setae broadly lanceolate (Fig. 11); peritreme ending in a small, rounded enlargement (Fig. 13) *Neopetrobia harteni* n. sp.
- True claws pad-like and empodium uncinat; dorsal body setae lanceolate; peritreme ending in a long sausage-like enlargement *Petrobia latens*
- 6 Tarsus I dorsally with two sets of closely associated duplex setae; empodia claw-like, single or associated with proximoventral hairs, or split distally into several hairs; dorsal body setae linear-lanceolate 7
- Tarsus I dorsally with a single set of loosely associated duplex setae, or duplex setae absent; empodium rudimentary, dorsal body setae subspatulate *Eutetranychus orientalis*
- 7 With two pairs of para-anal setae 8
- With one pair of para-anal setae 11
- 8 Empodium claw-like, with or without proximoventral hairs 9
- Empodium split into a tuft of hairs 10
- 9 Empodium a single claw-like structure (Fig. 17); dorsocentral, opisthosomal setae about as long as distances between consecutive setae (Fig. 14), not set on tubercles *Sonotetranychus wadicolus* n. sp.
- Empodial claw with proximoventral hairs; dorsocentral, opisthosomal setae longer than distances between consecutive setae, set on strong tubercles *Panonychus citri*
- 10 Empodium (Fig. 22) split at about distal third into several hairs, proximal part of empodium longer than these hairs; opisthosomal striae form a V-pattern between third pair of dorsocentral setae (e_1) (Fig. 18); aedeagus bent dorsad, bearing a knob distally (Fig. 24) *Mononychellus yemensis* n. sp.
- Empodium (Fig. 31) split at about distal half into several hairs, proximal part of empodium shorter than these hairs; opisthosoma completely with transverse striae; ae-

- deagus bent ventrad distally, with a terminal enlargement bearing an anterior and posterior angulation (Fig. 27) *Eotetranychus belus* n. sp.
- 11 Empodium claw-like, with short proximoventral hairs; duplex setae on tarsus I distal and approximate; aedeagus bent ventrad at a right angle to shaft and tapers gradually to an acute tip *Oligonychus ununguis*
- Empodium splits distally into a tuft of hairs; duplex setae on tarsus I separating tarsus into three more or less equal segments (genus *Tetranychus*) 12
- 12 Aedeagal knob with acute projections; lobes on female striae without basal spots ... 13
- Aedeagal knob with anterior and posterior projections rounded, dorsum of knob indented medially; female with lobes on striae predominantly rounded and bearing basal spots *Tetranychus neocaledonicus*
- 13 Male empodium I bearing a minute mediodorsal spur (Fig. 33); aedeagal knob about a third the length of dorsal margin of shaft (Fig. 35) *Tetranychus adensis* n. sp.
- Male empodium I with a strong mediodorsal spur; aedeagal knob about one fourth or less the length of dorsal margin of shaft *Tetranychus urticae*

Subfamily **Bryobiinae** Berlese, 1913

Bryobia praetiosa C.L. Koch, 1836

Bryobia praetiosa C.L. Koch, 1836. — Dt. Crust. Myriop. Arachn.: 8.

Bryobia praetiosa — Pritchard & Baker 1955; Mem. Pacific Coast Ent. Soc. Ser. 2: 26-32. — Mathys 1961; Ann. agric. Suisse 62: 295-304. — Livshitz & Mitrofanov 1971; Proc. St. Nikita Bot. Gard. 51: 59-60. — Meyer 1974; Ent. Mem. 36: 20-21.

Material: Yemen: 4 ♀♀, ex unidentified plants: Djebel An-Nabi Shuaib, 17.III.1993, A. van Harten; Wadi Udain, 13.III.1993, A. van Harten.

Diagnosis: Adult females are dark green to brownish-green, with pale red legs; newly hatched larvae are bright red but become green after they start to feed. Prodorsum of female with lateral projections triangular; femur I with 18-22 setae; peritremal enlargement about four times as long as broad; female empodium I is a short pad, bearing one pair of tenent hairs; true claws uncinuate; solenidia on tarsi III and IV associated with tactile setae, forming duplex sets; genu II with six setae. Dorsal body setae of larvae subspatulate to spatulate, varying in length from 21 to 28, and in breadth from 5 to 8.

Distribution and economic importance: *Bryobia praetiosa*, the clover mite, generally occurs on herbaceous plants world-wide. Large populations may damage lucerne, vegetables, cereals and clovers causing the foliage to turn yellow, eventually become bronzed and dry out. This species may also invade buildings.

Bryobia tuttlei Smiley & Baker, 1995 (Figs 1-9)

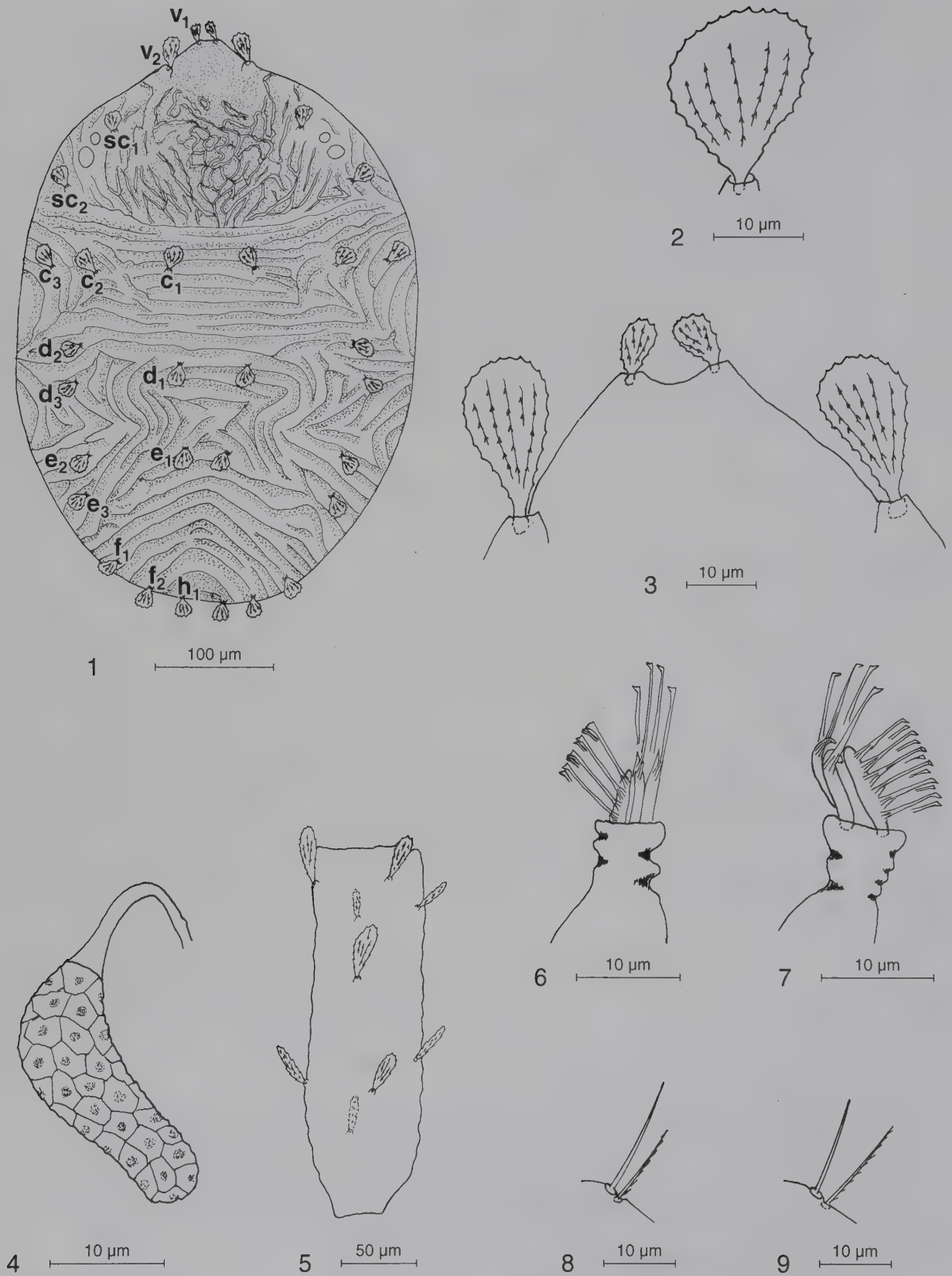
Bryobia tuttlei Smiley & Baker, 1995. — Int. J. Acarol. 21 (3): 138.

Material: Yemen: 2 ♀♀, between Ta'izz and At-Turbad, ex unidentified plant, 14.III.1993, A. van Harten.

Diagnosis: Prodorsum of female with three setiferous projections, medial pair fused, anterolateral projections weakly developed; true claws of leg I straight (Fig. 6); empodium I with about four pairs of tenent hairs.

Description: The following is a redescription of this species:

Female: Measurements: length of body (including projections) 485; breadth 308; length of leg I 323; leg II 231; leg III 247; leg IV 293. Dorsum (Fig. 1): Anterolateral setiferous projections



Figs 1-9: *Bryobia tuttlei*, ♀: 1, dorsal view; 2, dorsal seta; 3, prodorsal projections; 4, spermatheca; 5, femur I; 6, tarsal appendages of tarsus I; 7, tarsal appendages of tarsi II-IV; 8, duplex set on tarsus III; 9, duplex set on tarsus IV.

(Fig. 3) weakly developed, single anteromedial projection relatively broad, with two setae (v_1), less than half as long as second pair (v_2) on lateral projections; the latter is about a quarter as long as the medial projection; an imaginary line uniting the tops of setae v_2 passes more or less through bases of setae v_1 ; body setae broadly spatulate, serrate (Fig. 2); integument granulate; prodorsum with irregular to longitudinal striae; opisthosoma with coarse, mostly transverse striae. Receptaculum seminis as depicted in Fig. 4.

Legs: Counts of setae and solenidia (indicated in parentheses) on legs I-IV as follows ($n = 2$): coxae 2-1-1-1; trochanters 1-1-1-1; femora 8 or 9-7-4 or 5-5; genua 7 or 8-5-5-5; tibiae 9 (1)-4 or 5-5-5; tarsi 16 or 18 (3) + 2 dupl.-13 + 1 dupl.-12 + 1 dupl. 13 + 1 dupl.; solenidia on tarsi III and IV associated with tactile setae, forming duplex sets (Figs 8-9); true claws of legs II-IV unciniate, each bearing a pair of tenent hairs; empodium I (Fig. 6) pad-like, nearly as long as claws, with about four pairs of tenent hairs; empodia (Fig. 7) of other legs pad-like, about as long as claws, each with two rows of tenent hairs; femur I as depicted in Fig. 5.

Male and immature stages: Unknown.

Affinities: The shape of the prodorsal projections of the female and the structure of the claw complex of leg I resemble those of *B. oryctodia* Meyer, 1989; however, *B. tuttlei* can be distinguished from the latter species by the anterolateral setiferous prodorsal projections which are weakly developed, being merely tubercles. In *B. oryctodia* the anterolateral projections are well developed, about half the length of the anteromedial projection.

Bryobia rubrioculus (Scheuten, 1857)

Sannio rubrioculus Scheuten, 1857. — Arch. Naturg. 23 (1): 104-112.

Bryobia rubrioculus. — Van Eynhoven 1956; Entomol. ber. 16: 45-46. — Manson 1967; Acarologia 9 (1): 97-101. — Meyer 1974; Ent. Mem. 36: 23-26.

Material: Yemen: 2 ♀♀, Rayda, ex *Malus sylvestris* (apple), 11.II.1992, M. Knapp.

Diagnosis: Adult females are greenish-brown in colour, with reddish-brown legs; the newly hatched larvae are bright orange-red becoming green as they feed. Prodorsum of female normally with spine-like outgrowths; peritremal enlargements about twice as long as broad; femur I with 16-18 setae; true claws of leg I unciniate; solenidium on tarsus IV not associated with tactile seta; genu II with five setae. Dorsal body setae of larva spatulate, 20-24 long and 7-10 wide.

Distribution and economic importance: *Bryobia rubrioculus*, the brown fruit mite, is a pest of many deciduous fruit trees in temperate areas throughout the world. This mite may damage the leaves and flower buds, hindering the opening of the flowers. As the infestation and season continue, the injury spreads causing the whole tree to become lighter in colour. Leaves infested early on, fail to grow to the normal size.

Neopetrobia harteni n. sp. (Figs 10-13)

Holotype: ♀, Yemen: between Ta'izz and Al Mukha, ex unidentified plant, 15.III.1993, A. van Harten, accession no. AcY 94/2, slide no. 1.

Diagnosis: Legs I shorter than body; dorsal body setae relatively short; peritremal enlargement weakly anastomosed, consisting of a few branches.

Description of female: Measurements of holotype: length of body (including gnathosoma) 531; length (excluding gnathosoma) 486; breadth 339; length of leg I 354; leg II 246; leg III 277; leg IV 308. Dorsum as shown in Fig. 10. Body oval; body setae (Fig. 11) broadly lanceolate, serrate; prodorsal setae (v_2 , sc_{1-2}) about equal in length to opisthosomal setae f_{1-2} and h_1 whereas opisthosomal setae c_{1-3} , d_{1-2} and e_{1-2} are closer together than those of first pair of dorso-central setae (c_1); opisthosomal setae much shorter than distances between bases of consecutive se-

tae; medial shield area of prodorsum with finely dashed, transverse striae; remainder of prodorsum with coarse, longitudinal striae; opisthosoma provided with transverse striae dorsocentrally. Receptaculum seminis as depicted in Fig. 12.

Gnathosoma: Stylophore indented anteriorly; distal end of peritreme weakly anastomosed, consisting of a few branches (Fig. 13).

Legs: Setae and solenidia (in parentheses) on legs I-IV as follows: coxae 2-2-1-1; trochanters 1-1-1-1; femora 9-6-4-4; genua 5-5-4-4; tibiae 13 (1)-9-9-9; tarsi 18 (2) + 2 dupl.-12 (2) + 1 dupl.-14 (1)-14 (1); tarsus I bears two solenidia and 11 tactile setae well proximal to duplex sets; solenidia and tactile setae on tarsi III and IV well separated; empodial pads about as long as pads of true claws and with two rows of ventrally directed hairs.

Male and immature stages: Unknown.

Affinities: This species resembles *N. concolor* (Chaudhri, 1974) in body form and, to a certain extent, the striation pattern and the number of leg setae. The short, dorsal body setae and their arrangement also resemble those of *N. concolor*. However, *N. harteni* is distinguished from the latter species by legs I which are shorter than the body. In *N. concolor* legs I are distinctly longer than the body. This species further differs in that the peritremal enlargement is weakly anastomosed, consisting of a few branches whereas in *N. concolor* the peritremal anastomosis is more complex.

Etymology: I have pleasure in naming this species after Mr. A. van Harten, who has sent many mite specimens to me in the past.

Petrobia latens (Müller, 1776)

Acarus latens Müller, 1776. — Zoologicae Danicae Prodromus: 187.

Petrobia latens. — Oudemans 1929; Krit. Hist. overz. Akarol. 2: 285. — Pritchard & Baker 1955; Mem. Pacific Coast Ent. Soc. Ser. 2: 51. — Wainstein 1960; Kaz. Akad. Selsk. Nauk N.-Issled. Inst. Zash. Rast. Trudy 5: 134-136. — Meyer 1974; Ent. Mem. 36: 130. — Meyer 1987; Ent. Mem. 69: 71-73.

Material: Yemen: 3 ♀♀, around Zinjibar, ex unidentified plant, 20.III.1993, A. van Harten.

Diagnosis: Dorsal body setae of female not set on tubercles and shorter than intervals between consecutive setae; legs I much longer than body; dorsal striae without lobes; peritreme ends in a slender enlargement, which is much longer than broad; tarsi III and IV with duplex sets; empodia uncinata bearing two rows of ventrally directed tenent hairs.

Distribution and economic importance: *Petrobia latens*, the brown wheat mite, has a world-wide distribution and an extensive range of hosts of which monocotyledonous plants are the most important. It is a dry-weather pest of wheat, other small grain, cultivated grasses, lucerne, sorghum, cotton and vegetables. The first symptoms of damage by this mite are chlorotic spots on the leaves, which later become pale yellow to bronze. Eventually damaged leaves become brown and die.

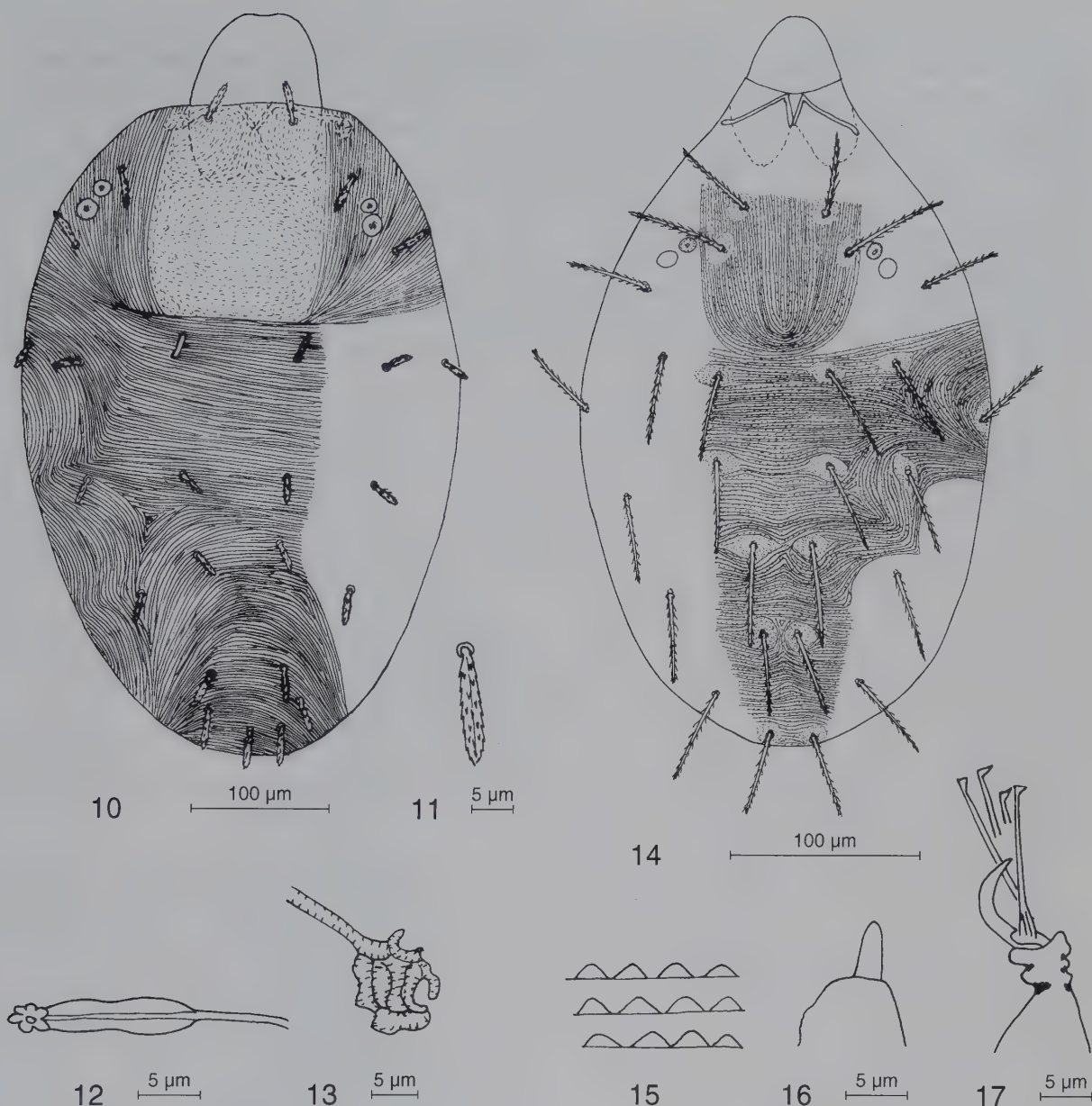
Subfamily Tetranychinae Berlese, 1913

Eutetranychus orientalis (Klein, 1936)

Anychus orientalis Klein, 1936. — Bull. Agric. Res. Stat. Rehovoth 21: 3.

Eutetranychus orientalis. — Baker & Pritchard 1960; Hilgardia 29 (11): 464. — Meyer 1974; Ent. Mem. 36: 138-139. — Meyer 1987; Ent. Mem. 69: 80-82.

Material: Yemen: 10 ♀♀: between Ta'izz and Al Mukha, ex unidentified plant, 15.III.1993, A. van Harten; Ta'izz, ex *Citrus* sp., 16.II.1993, M. Knapp; Hamam Ali, ex *Citrus* sp., 16.II.1992, A. van Harten; Wadi Hadramaut, ex unidentified plant, 25.IV.1992, A. van Harten.



Figs 10-17: 10-13, *Neopetrobia harteni* n. sp., ♀: 10, dorsal view; 11, dorsal seta; 12, spermatheca; 13, termination of peritreme. 14-17, *Sonotetranychus wadicolus* n. sp., ♀: 14, dorsal view; 15, lobes on dorsal striae; 16, palptarsus; 17, tarsal appendages of tarsus I.

Diagnosis: Adult females broad, oval, vary in colour from brownish-green to dark green, with darker spots within the body; legs I of the female are about as long as the body; legs yellow-brown. The males are smaller and triangular in shape, with longer legs than the females. The dorsal body setae of the females are located on tubercles, varying in length and shape; dorsolateral setae long, lanceolate to subspatulate or broadly spatulate; dorsocentral setae short and spatulate or lanceolate to subspatulate; striae on prodorsum longitudinal and tuberculate; striation pattern between second and third pairs of dorsocentral setae varies from longitudinal to V-shaped; tibia II with six setae, genu III with two, tibia III with six and coxa II with one seta. The eggs are flattened, without a stalk, clear at first, later parchment-yellow.

Distribution and economic importance: This species is commonly called the brown citrus mite and is a pest of *Citrus* but can also damage cotton and vegetables. It occurs in Palestine, the Far East, northern and southern Africa. These mites feed on fruit and the upper surfaces of leaves, this causes chlorotic stippling in the same locations. As infestation progresses the plants becoming silver-grey in appearance, some leaves turn yellow and drop, twigs may die back.

***Sonotetranychus wadicolus* n. sp. (Figs 14-17)**

Holotype: ♀, Yemen: Wadi Bana, ex unidentified plant, 26.X.1992, A. van Harten, accession no. AcY 94/9, slide no. 1.

Diagnosis: Female with dorsocentral, opisthosomal setae about as long as intervals between consecutive setae; striae between third pair of dorsocentral setae widely V-shaped; lobes on striae rounded.

Description of female: Dimensions of holotype: length of body (including gnathosoma) 406; length of body (excluding gnathosoma) 331; breadth 236. Dorsum (Fig. 14): Body setae linear-lanceolate, serrate; prodorsal setae (v_2 , sc_2) about equal in length and about three quarters the length of second pair (sc_1); dorsocentral, opisthosomal setae (c_1 , d_1 , e_1 , f_1) extend to bases of setae next behind; striae on prodorsum longitudinal and those on opisthosoma generally transverse; striae between third pair of dorsocentral setae (e_1) widely V-shaped, with longitudinal striae between f_1 ; lobes on striae rounded, sometimes tending to be broadly triangular (Fig. 15).

Gnathosoma: Stylophore rounded anteriorly; peritreme ends simply distally; terminal eupathidium on palptarsus (Fig. 16) about 2.5 times as long as broad.

Legs: Setae and solenidia (in parentheses) disposed on legs I-IV as follows: coxae 2-2-1-1; trochanters 1-1-1-1; femora 8-7-3-2; genua 5-5-4-3; tibiae 9 (1)-5-5-5; tarsi 13 (1) + 2 dupl.-12 (1) + 1 dupl.-10 (1)-10; tarsus I with four tactile setae and one solenidium well proximal to duplex sets; empodia strongly uncinata (Fig. 17).

Male and immature stages: Unknown.

Affinities: The dorsal body setae of this species resemble those of *S. albiflorae* (Tuttle & Baker, 1968) but *S. wadicolus* differs in that the dorsocentral, opisthosomal setae are about as long as the distances between consecutive setae and not longer as in *S. albiflorae*. There are also less setae on femora I and III-IV, and tibiae II-IV (8, 3-2, 5-5-5 for *S. wadicolus* as opposed to 9, 4-3, 6-6-6 for *S. albiflorae*).

***Panonychus citri* (McGregor, 1916)**

Tetranychus citri McGregor, 1916. — Ann. Ent. Soc. Am. 9: 284.

Panonychus citri. — Ehara 1956; J. Fac. Sci. Hokkaido Univ. (6) 12: 500. — Meyer 1974; Ent. Mem. 36: 187. — Meyer 1987; Ent. Mem. 69: 97-98.

Material: Yemen: 4 ♀♀, Ta'izz, ex *Citrus* sp., 16.II.1993, M. Knapp.

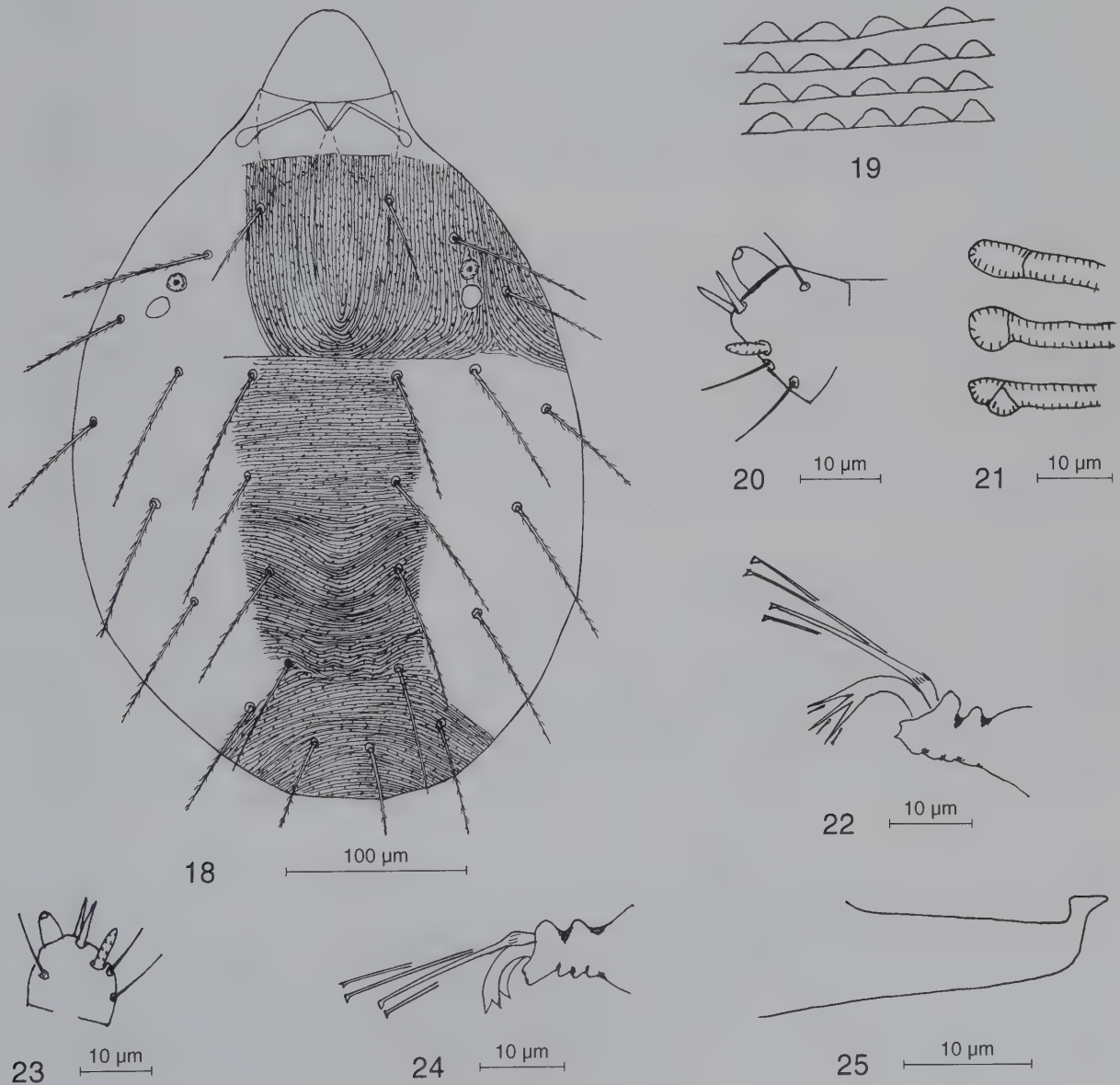
Diagnosis: Adult females are oval and dark red; long white setae arise from prominent tubercles on the dorsum; the female of this species can be distinguished from related species by the fourth pair of dorsolateral and fifth pair of dorsocentral setae which are equal in length and about a third the length of the fourth pair of dorsocentral setae. The males are reddish, smaller than females and pointed posteriorly; aedeagus with shaft narrowing distally and distal part curved dorsad. The eggs are small, red and onion-shaped, with an upright stalk and guy threads to the surface of the leaf.

Distribution and economic importance: *Panonychus citri* is commonly called the red citrus mite and is a pest of *Citrus* and several other broad-leaved evergreens. It occurs in most *Citrus*-growing areas of the world. These mites feed on fruit, leaves and the green bark of *Citrus*.

They prefer the upper surfaces of leaves, which become stippled and later grey, silver or yellow. Similar damage is done to the fruit which is often reduced in size or dropped prematurely due to weakening of the fruit stem.

Mononychellus yemensis n. sp. (Figs 18-25)

Holotype: ♀, Yemen: between Ta'izz and Mafraq, ex unidentified plant species of the Leguminosae, 15.III.1993, M. Knapp, accession no. AcY 94/7, slide no. 1. — Paratypes: 3 ♀♀, 2 ♂♂, 1 deutonympha, same data as holotype, slide nos 2-7; 5 ♀♀, between Mafraq and Mocha, same data as holotype, accession no. AcY 94/6, slide nos 1-5; 2 ♀♀, 1 ♂, between Mafraq and Zabid, ex unidentified plant, same data as holotype, accession no. AcY 94/5, slide nos 1-3; 3 ♀♀, Ibb-Ta'izz-Mocha region, ex unidentified plant, 22.III.1993, A. van Harten, accession no. AcY 94/4, slide nos 1-3; 1 ♀, Wadi Hadramaut, ex unidentified plant, 25.IV.1992, A. van Harten, accession no. AcY 94/3, slide no. 1.



Figs 18-25: *Mononychellus yemensis* n. sp.: 18, dorsal view of ♀; 19, lobes on dorsal striae of ♀; 20, palptarsus of ♀; 21, variations in the termination of the peritremes of ♀; 22, tarsal appendages of tarsus I of ♀; 23, palptarsus of ♂; 24, tarsal appendages of tarsus I of ♂; 25, aedeagus.

Diagnosis: This species is characterised by the dorsal body setae of the female which are longer than the distances between consecutive setae and in that the male aedeagus terminates in a knob.

Description of female: Dimensions of holotype (measurements in parentheses indicate variations in the paratypes): length of body (including gnathosoma) 408 (300-439); length (excluding gnathosoma) 333 (253-347); breadth 277 (185-293). Dorsum as shown in Fig. 18. Body setae sparsely setose; second (sc_1) and third (sc_2) pairs of prodorsal setae subequal in length and longer than first pair (v_2); opisthosomal setae extend past bases of setae in next row; prodorsum with a simple longitudinal, dorsocentral striation pattern, U-shaped posteriorly; opisthosomal pattern transverse, except for a V-pattern between third pair of dorsocentral setae (e_1); lobes on striae rounded (Fig. 19).

Gnathosoma: Stylophore rounded anteriorly; terminal eupathidium on palptarsus (Fig. 20) about as long as broad; peritreme ends simply, as depicted in Fig. 21.

Legs: Numbers of setae and solenidia (in parentheses) on legs I-IV as follows: coxae 2-2-1-1; trochanters 1-1-1-1; femora 9-7-4-3; genua 5-5-4-4; tibiae 9 (1)-7-6-6 or 7; tarsi 13 (1) + 2 dupl.-12 (1) + 1 dupl.-10 (1)-10 (1); tarsus I with four tactile setae and one solenidium proximal to duplex set; distal part of empodium splitting into six hairs that are shorter than the proximal part of the empodium (Fig. 22).

Description of male: Dorsal aspect resembles female. **Gnathosoma:** Terminal eupathidium on palptarsus (Fig. 23) slightly longer than broad.

Legs: Setae and solenidia (in parentheses) on legs I-IV as follows: femora 9-7-4-3; genua 5-5-4-4; tibiae 9 (4)-7-6-7; tarsi 13 (3) + 2 dupl.-12 (1) + 1 dupl.-10 (1)-10 (1); tarsus I bears four tactile setae and two solenidia proximal to duplex sets; tarsus II with two tactile setae and one solenidium well proximal to duplex set; empodia I (Fig. 24) and II each with two bidentate spurs whereas empodia III and IV each with three pairs of proximoventral hairs.

Aedeagus (Fig. 25): Shaft bends dorsad, distal end forms a knob with a small, acute angulation anteriorly and a longer one posteriorly.

Description of deutonympha: Dorsum similar to that of female but chaetotaxy of legs I-IV differs as follows: coxae 2-2-1-1; trochanters 1-1-1-0; femora 6-3-2-2; genua 5-5-2-2; tibiae 7 (1)-5-5-5; tarsi 12 (1) + 2 dupl.-10 + 1 dupl.-8 (1)-8.

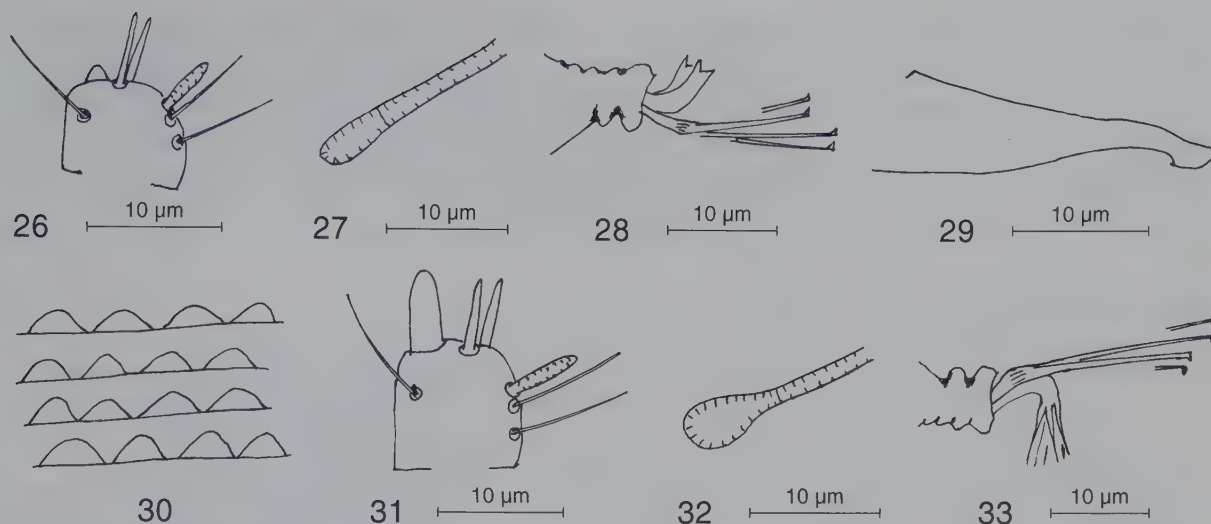
Affinities: The dorsum of the female resembles that of *M. virosus* (Meyer, 1974) in that the striae between the third pair of dorsocentral setae (e_1) form a V-pattern, the dorsal body setae are longer than the distances between consecutive setae and the aedeagus curves dorsad. However, *M. yemensis* differs in that the aedeagus terminates in a knob, bearing anterior and posterior angulations.

Eotetranychus belus n. sp. (Figs 26-33)

Holotype: ♂, Yemen: Ta'izz, ex *Mangifera indica* (mango), 16.II.1993, M. Knapp, accession no. AcY 94/10, slide no. 1.
— **Paratypes:** 5 ♀♀, 1 deutonympha, same data as holotype, slide nos 2-7; 5 ♀♀, 2 ♂♂, 3 deutonymphae, same data as holotype, ex *Coffea arabica* (coffee), 17.II.1993, accession no. AcY94/11, slide nos 1-10.

Diagnosis: This species is distinguished by the male aedeagus bending ventrad distally, forming a distal knob, which is about one sixth as long as dorsal margin of shaft and male empodia I and II each consisting of bidentate spurs.

Description of male: **Gnathosoma:** Terminal eupathidium on palptarsus (Fig. 26) small, conical, about as long as broad; peritreme straight distally, ending in a slightly expanded simple bulb (Fig. 27).



Figs 26-33: *Eotetranychus belus* n. sp.: 26, palptarsus of ♂; 27, termination of peritreme of ♂; 28, tarsal appendages of tarsi I-II of ♂; 29, aedeagus; 30, lobes on dorsal striae of ♀; 31, palptarsus of ♀; 32, termination of peritreme of ♀; 33, tarsal appendages of tarsi I-IV of ♀.

Legs: Setae and solenidia (in parentheses) on legs I-IV are as follows: femora 10-6 or 7-4-4; genua 5-5-4-4; tibiae 9 (4)-8-6-7; tarsi 13 (3) + 2 dupl.-13 (1) + 1 dupl.-10 (1)-10 (1); tarsus I bears four tactile setae and two solenidia well proximal to duplex sets; tarsus II with two tactile setae and one solenidium well proximal to duplex set; empodia I and II each with bidentate spurs (Fig. 28); empodia III and IV each with three pairs of proximoventral hairs.

Aedeagus (Fig. 29): Shaft long, strong and nearly straight; knob about one sixth the length of dorsal margin of shaft, with distal margin angulate and anterodorsally and posteroventrally directed projections.

Description of female: Dimensions: length of body (including gnathosoma) 453-517; length (excluding gnathosoma) 276-316; breadth 162-193. Dorsum: Body setae linear-lanceolate, pubescent, extending past bases of setae next behind; prodorsum with longitudinal striae whereas opisthosoma bears transverse striae; lobes on striae semicircular (Fig. 30). Venter: Striae on genital flap transverse and those immediately anterior to flap vary in different specimens in the same populations from being transverse to irregularly longitudinal.

Gnathosoma: Peritreme terminates in a simple bulb (Fig. 31); terminal eupathidium (Fig. 32) on palptarsus twice as long as broad.

Legs: Setae and solenidia (in parentheses) on legs I-IV are as follows: coxae 2-2-1-1; trochanters 1-1-1-1; femora 9-7-4-4; genua 5-5-4-4; tibiae 9 (1)-7-6-7; tarsi 13 (1) + 2 dupl.-12 (1) + 1 dupl.-9 (1)-9 (1); tarsus I with four tactile setae proximal to duplex sets; empodia with three pairs of proximoventral hairs (Fig. 33).

Description of deutonympha: The deutonympha exhibits the same diagnostic characters as the female except that the terminal eupathidium is about 2.5 times as long as broad; setae and solenidia (indicated in parentheses) of legs I-IV are as follows: coxae 2-2-1-1; trochanters 1-1-1-0; femora 5 or 6-3-2-2; genua 5-5-3-3; tibiae 7 (1)-5-5-5; tarsi 12 (1) + 2 dupl.-10 + 1 dupl.-8 (1)-8.

Affinities: The aedeagus of *E. belus* is similar to that of *E. pronus* Davis, 1969 and *E. paredi* Meyer, 1974, but differs in that the distal knob is about one sixth as long as the dorsal margin of

the shaft and not one fifth as in the above-mentioned species. It further resembles these species in that the male tibia II bears eight setae and the female tarsus I five tactile setae and one solenidion proximal to the duplex setae. However, it further differs from *E. pronus* and *E. paredi* in that the male empodia I and II each consist of bidentate spurs. In the latter species, empodia I have the median pairs of hairs spur-like but also have weak dorsal and ventral hairs. Empodia II of these species are not spur-like but consist of proximoventral hairs.

Oligonychus ununguis (Jacobi, 1905)

Tetranychus ununguis Jacobi, 1905. — Naturw. Zeitschr. Forst Landw. 3: 239.

Oligonychus ununguis. — Pritchard & Baker 1955; Mem. Pacific Coast Ent. Soc. Ser. 2: 319-327. — Livshitz & Mitrofanov 1969; Bjull. Gosud. Nikit. Bot. Sada Ent. Fitopat. 1 (8): 41-43. — Mitrofanov et al. 1975; Latvijas ent. Suppl. 3: 10. — Meyer 1987; Ent. Mem. 69: 148.

Material: Yemen: 3 ♀♀, 2 ♂♂, Jihana, ex *Cupressus* sp. (cypress), 21.I.1992, A. van Harten.

Diagnosis: Adult females dark red to purplish-black; female tibia I with seven tactile setae and tarsus II with three tactile setae well proximal to duplex sets; terminal eupathidium on female palptarsus about 1.3-1.8 times as long as broad and that on male palptarsus slightly longer than broad; aedeagus bends ventrad at a right angle to shaft and tapers gradually to an acute tip.

Distribution and economic importance: *Oligonychus ununguis* is a serious pest of conifers throughout the world. Mite feeding causes the needles to turn brown. During severe infestations the trees appear brown and drop their needles until they are bare.

Tetranychus adensis n. sp. (Figs 34-41)

Holotype: ♂, Yemen: between Aden and Little Aden, ex unidentified plant, 10.IV.1993, A. van Harten, accession no. AcY 94/12, slide no. 1. — **Paratypes:** 10 ♀♀, 2 ♂♂, same data as holotype, slide nos 2-13.

Diagnosis: This species is distinguished by the male aedeagus curving dorsad and forming a knob which is about one fourth the length of the dorsal margin of the shaft; eupathidium on male palpus about 1.5 times as long as broad and that on female palptarsus about as long as broad.

Description of male: Gnathosoma: Palptarsus with a terminal eupathidium that is about 1.5 times as long as broad (Fig. 34); peritreme ending in a small hook distally.

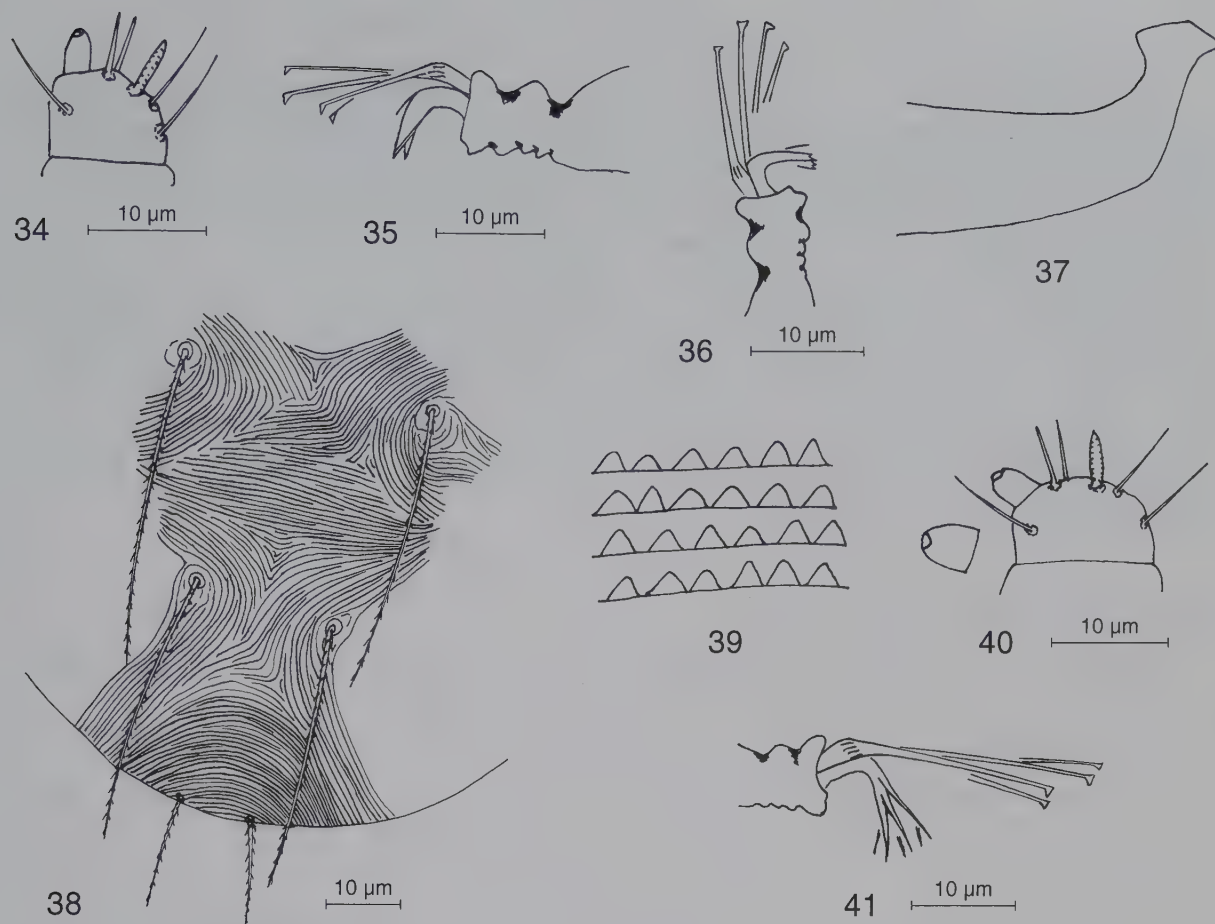
Legs: Setae and solenidia (in parentheses) on legs I-IV as follows: femora 9 or 10-6-4-4; genua 5-5-4-4; tibiae 9 (4)-7-6-6 or 7; tarsi 13 (3) + 2 dupl.-11 (1) + 1 dupl.-9 (1)-9(1); tarsus I bears four tactile setae and three solenidia immediately behind proximal pair of duplex sets; mediodorsal spur on empodium II (Fig. 36) with two proximoventral spurs; mediodorsal spur apparently absent; empodia III and IV with three pairs of proximoventral hairs.

Aedeagus (Fig 37): Shaft of aedeagus narrows distally, curves dorsad to form a knob with acute anterior and posterior projections; dorsal margin of knob angulate; axis of knob parallel to shaft axis; knob about one fourth the length of dorsal margin of shaft.

Description of female: Dimensions: length of body (including gnathosoma) 507-560; length (excluding gnathosoma) 397-462; breadth 239-316. Dorsum: Body setae longer than distances between bases of consecutive setae; striae between third (e_1) pair of dorsocentral setae irregular to longitudinal, between fourth pair of dorsocentral setae (f_1) longitudinal; transverse striae form a diamond-shaped pattern between third (e_1) and fourth (f_1) pairs of dorsocentral setae (Fig. 38); lobes on striae triangular (Fig. 39). Venter: Medioventral striae smooth.

Gnathosoma: Palptarsus (Fig. 40) with terminal eupathidium about as long as broad; peritreme retrorse distally.

Legs: Setae and solenidia (in parentheses) on legs I-IV are as follows: coxae 2-2-1-1; trochanters 1-1-1-1; femora 10-6-4-4; genua 5-5-4-4; tibiae 9 (1)-7-6-7; tarsi 13 (1) + 2 dupl.-13 (1)



Figs 34-41: *Tetranychus adensis* n. sp.: 34, palptarsus of ♂; 35, tarsal appendages of tarsus I of ♂; 36, tarsal appendages of tarsus II of ♂; 37, aedeagus; 38, striation pattern between third and fourth pairs of dorsocentral setae of ♀; 39, lobes on dorsal striae of ♀; 40, palptarsus of ♀; 41, tarsal appendages of tarsi I-IV.

+ 1 dupl.-9 (1)-10 (1); four tactile setae located immediately behind proximal pair of duplex setae on tarsus I; tarsus II with two tactile setae and one solenidion well proximal to duplex sets; empodia with three pairs of proximoventral hairs (Fig. 41).

Affinities: The aedeagus is somewhat similar to those of *T. gardeniae* Meyer, 1974 and *T. lombardinii* Baker & Pritchard, 1960, in curving dorsad and bearing a distal knob. As in the latter two species, empodium I of the male is also devoid of a mediodorsal spur or with spur minute. However, *T. adensis* differs from these species in that the terminal eupathidia on the male and female palptarsi are shorter (1.5 times as long as broad on the male palptarsus and about as long as broad on the female palptarsus of *T. adensis* as opposed to four times as long as broad on the male palptarsus of *T. gardeniae*, three times as long as broad on the male palptarsus of *T. lombardinii* and twice as long as broad on the female palptarsus of both the latter species).

Tetranychus neocaledonicus André, 1933

Tetranychus neocaledonicus André, 1933. — Bull. Mus. Nat. Hist. Nat. Paris 5: 302

Tetranychus neocaledonicus. — Boudreaux & Dosse 1963; Acarologia 5 (1): 20-21. — Meyer 1974; Ent. Mem. 36: 238-239.

— Meyer 1987; Ent. Mem. 69: 137-138.

Material: Yemen: 3 ♀♀, 2 ♂♂: Hadibo, Socotra, ex *Jatropha?* sp., 13.IV.1993, A. van Harten; between Ta'izz and Mafrq, 15.III.1993, M. Knapp.

Diagnosis: The adult females are dark red; males are smaller, lighter in colour and pointed posteriorly; male aedeagus bends dorsad at nearly a right angle, anterior and posterior projections of knob rounded and separated by a small, dorsal indentation; male empodium I with a small, mediodorsal spur, about one fourth the length of proximoventral hairs; lobes on dorsal striae of female different shapes and sizes but mostly semicircular with basal spots.

Distribution and economic importance: *Tetranychus neocaledonicus* is well distributed throughout tropical and subtropical areas of the world. It has a wide range of hosts and attacks flowers, fruit trees and many vegetable and field crops. The mites suck the plant sap from the leaves, producing chlorotic stippling that gradually coalesces as feeding continues. Leaves lose their green colour, gradually wilt, dry and drop. The decreased vitality and leaf drop adversely affect plant growth, flowering and fruiting. The mites web profusely and may form a thick sheath of webbing that covers the entire plant.

Tetranychus urticae C.L. Koch, 1836

Tetranychus urticae C.L. Koch, 1836. — Dt. Crust. Myriop. Arachn.: 10.

Tetranychus urticae. — Boudreaux & Dosse 1963; Adv. Acarol. I: 350-360. — Meyer 1974; Ent. Mem. 36: 234. — Dupont 1979; Ent. Exp. Appl. 25: 297-303. — Meyer 1987; Ent. Mem. 69: 136-137.

Tetranychus telarius. — Pritchard & Baker 1955; Mem. Pacific Coast Ent. Soc. Ser. 2: 432. — Van Eynhoven & Boudreaux 1969; Bull. zool. nomencl. 26 (2): 71 (synonymy).

Tetranychus cinnabarinus. — Boudreaux 1956; Ann. Ent. Soc. Am. 49 (1): 43. — Meyer 1974; Ent. Mem. 36: 235-238. — Dupont 1979; Ent. Exp. Appl. 25: 297-303 (synonymy).

Material: Yemen: 7 ♀♀, 4 ♂♂: Sana'a, ex *Malus sylvestris* (apple), 15.II.1992, A. van Harten; same data, ex *Althaea rosea* (hollyhock), 8.II.1992.

Diagnosis: Currently *T. urticae* can be defined as follows: Male aedeagus with a small knob, set at right angles to the neck, the anterior and posterior projections small and equal; male empodium I with a strong mediodorsal spur, other empodia with proximoventral hairs, similar to those of the female; lobes on the dorsal striae of the female vary from triangular to semicircular.

Distribution and economic importance: *Tetranychus urticae* is generally called the common red spider mite or two-spotted spider mite. It is the most destructive spider mite and an important pest of cotton, other field crops, fruit trees, vegetables and ornamentals. Resistance to pesticides is common among populations of this mite and often develops rapidly. Feeding of these mites on the leaves results in yellow stippling followed by chlorosis or bronzing of whole leaves. The growth of the plants is retarded and defoliation may occur.

Remarks: This species consists of a species-complex, which now includes *T. cinnabarinus* since the experimental studies of DUPONT (1979). From her findings she concluded that all the races or strains are morphologically very similar, recalled that the differences in colour are only due to differences in pigment quantities and demonstrated that there is a gene flow between the carmine and green forms.

ACKNOWLEDGEMENTS

I wish to thank Dr. E.A. Ueckermann and Mrs. J.C.S. van Dis, both of the Plant Protection Research Institute, Pretoria, for their assistance.

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Some Phytoseiidae of Yemen (Acari: Mesostigmata)

Eddie A. Ueckermann

Abstract: A survey of mites on deciduous fruit trees and various other plants in Yemen yielded 11 phytoseiid species, four of which are new, namely: *Typhlodromus charactus*, *T. adenensis*, *T. aenaulus* and *Amblyseius lecodactylus*. The seven known species are new records for Yemen. A key to the genera and species is given.

بعض أنواع عائلة Phytoseiidae من اليمن (رتبة الأكاروس : Mesostigmata)

أدي. آ. أوكرمان

خلاصة : نتج عن الدراسة المسحية عن الحلم في مناطق من اليمن فيها أشجار مثمرة ونباتات أخرى مختلفة وجود ١١ نوعاً من phytoseiid، ٤ أنواع منها جديدة للعلم هي : *Typhlodromus charactus*، *T. adenensis*، *T. aenaulus* و *Amblyseius lecodactylus*. أما الأنواع السبعة الأخرى فتمثل تسجيلات جديدة من اليمن. وتحتوى الدراسة على مفاتيح تصنيف للأجناس والأنواع.

INTRODUCTION

Phytoseiids are important biocontrol agents in integrated pest management programmes world-wide. *Amblyseius barkeri* (Hughes, 1948) for instance can effectively control the spider mite *Tetranychus urticae* C.L. Koch, 1836 and the tobacco thrips *Thrips tabaci* Lindeman, 1889 on cucumber in greenhouses (SAION 1987; TABORSKY et al. 1988; LINDQVIST & TIITANEN 1989; HANSEN 1988, 1989; KARG et al. 1978). *A. swirskii* Athias-Henriot, 1962 is common in citrus orchards in Israel (PORATH & SWIRSKI 1965) and on deciduous trees in Egypt (YOUSEF & SHEHATA 1971) and is a facultative predator (SWIRSKI et al. 1967).

Judging from the literature listed in the Zoological Records to date, no information concerning the phytoseiids of Yemen is available. This paper deals with the phytoseiids collected during a survey of mites by Mr. A. van Harten and Mr. M. Knapp who are engaged in the Yemeni-German Plant Protection Project. Eleven species were recorded of which four are new to science. The type material of the new species is deposited in the National Collection of Arachnida, Agricultural Research Council, Plant Protection Research Institute, Biosystematics Division, Pretoria, Republic of South Africa.

The formulae given for the dorsal and ventral setal patterns are according to the system of CHANT & YOSHIDA-SHAUL (1992). The setal nomenclature follows that of ROWELL et al. (1978). All measurements are given in micrometres (µm).

Key to some phytoseiid species from Yemen, females

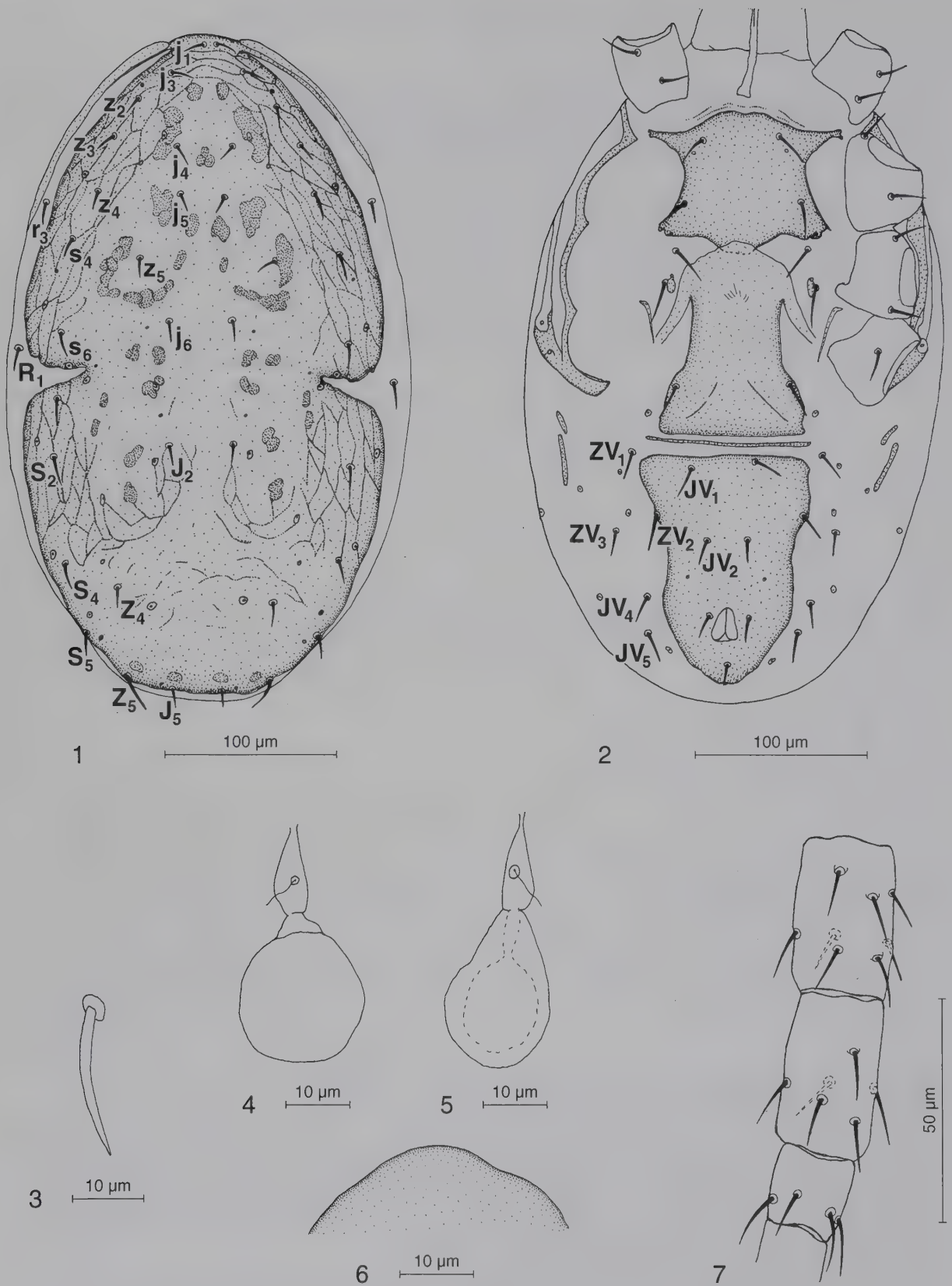
- | | | |
|----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|
| 1 | Podonotum with six pairs of lateral setae: $j_3, z_2, z_3, z_4, s_4, s_6$ (genus <i>Typhlodromus</i>) . . . | 2 |
| — | Podonotum with four pairs of lateral setae: j_3, z_2, z_4, s_4 | 6 |
| 2 | Ventro-anal shield with four pairs of pre-anal setae; dorsal shield slightly indented mediolaterally | 3 |
| — | Ventro-anal shield with three pairs of pre-anal setae (Fig. 2); dorsal shield deeply incised mediolaterally (Fig. 1) | <i>Typhlodromus charactus</i> n. sp. |
| 3 | Setae S_4 and S_5 equal or subequal in length | 4 |
| — | Setae S_5 clearly shorter than S_4 | 5 |
| 4 | All dorsal shield setae except J_5 blunt distally (Fig. 8); ventro-anal shield without pre-anal pores (Fig. 9) | <i>Typhlodromus adenensis</i> n. sp. |
| — | All dorsal shield setae pointed, except Z_4 and Z_5 which are knobbed (Fig. 14); ventro-anal shield with pre-anal pores (Fig. 15) | <i>Typhlodromus aenaulus</i> n. sp. |
| 5 | Setae Z_5 pointed; genu II with eight setae | <i>Typhlodromus praeacutus</i> |
| — | Setae Z_5 knobbed; genu II with seven setae | <i>Typhlodromus persianus</i> |
| 6 | Interscutal membrane sclerotised; ventro-anal shield divided | <i>Iphiseius degenerans</i> |
| — | Interscutal membrane not sclerotised; ventro-anal shield rarely divided (genus <i>Amblyseius</i>) | 7 |
| 7 | Dorsal shield setae blunt distally and on distinct tubercles, shield almost covered with polygonal cells or "wax plates"; ventro-anal shield without pre-anal pores | <i>Amblyseius desertorum</i> |
| — | Dorsal shield setae pointed, not on tubercles, shield without cells; ventro-anal shield with pre-anal pores | 8 |
| 8 | Pre-anal setae almost aligned in a transverse row | 9 |
| — | Pre-anal setae not arranged as above | 10 |
| 9 | All dorsal shield setae, except z_5 and J_5 , long (Fig. 20); macrosetae on legs knobbed (Fig. 23) | <i>Amblyseius nyalensis</i> |
| — | All dorsal shield setae, except j_1, j_3, s_4 and Z_5 , short (Fig. 29); leg IV with hyaline tipped macrosetae (Fig. 31) | <i>Amblyseius lecodactylus</i> n. sp. |
| 10 | All dorsal shield setae, except Z_4 and Z_5 , short; leg IV with one macroseta | <i>Amblyseius barkeri</i> |
| — | All dorsal shield setae, except j_1, j_3, s_4, Z_4 and Z_5 , short; leg IV with 3 long macrosetae | <i>Amblyseius swirskii</i> |

Typhlodromus charactus n. sp. (Figs 1-7)

Holotype: ♀, Yemen: Wadi Udain, ex unidentified plant, 13.III.1993, A. van Harten, accession no. AcY 94/25, slide no. 1. — Paratypes: 2 ♀♀, same data as holotype, slide nos 2-3.

Diagnosis: This species is characterised by the deep incisions medially in the lateral margins of the dorsal shield, the presence of three pairs of pre-anal setae on the ventro-anal shield, the absence of macrosetae on the legs, and genua II and IV both bearing eight setae. The dorsal and ventral setal patterns are 12A:8A and JV-3:ZV, respectively.

Description of female: Measurements of holotype (data for paratypes in parentheses): length of body 397 (384-419); breadth 208 (205-214); length of sternal shield 88 (88-91); breadth 95 (101); breadth of genital shield 88 (85-86); length of ventro-anal shield 139 (135-139); breadth



Figs 1-7: *Typhlodromus charactus* n. sp., ♀: 1, dorsum; 2, venter; 3, seta Z_5 ; 4-5, spermatheca; 6, anterior margin of tectum; 7, leg IV.

104 (101-105); setae: j_1 , j_4 , j_5 , j_6 , J_2 and z_5 13 (13-16); j_3 , z_3 , z_4 , s_4 , s_6 , S_2 , S_4 , r_3 and S_5 16 (16-19); J_5 9 (9-13); z_2 , Z_4 and R_1 14 (13-16); Z_5 and JV_5 19 (19).

Dorsum (Fig. 1): Dorsal shield reticulated and deeply incised mediolaterally, with rugose patches, 21 pairs of pores and 18 pairs of smooth, short setae (Fig. 3). Holotype with an extra seta on one side of opisthonotum, in a S_1 position. Setae r_3 and R_1 are placed on the interscutal membrane. Peritremes extend to level of setae j_1 .

Venter (Fig. 2): Sternal shield smooth, bearing two pairs of setae and pores. Third pair of sternal setae on cuticle and fourth pair and third pair of pores on small metasternal shields. Posterior margin of sternal shield with a convex lobe medially. Genital shield broad and truncated posteriorly, with one pair of setae. Ventro-anal shield broadest anteriorly, slightly concave laterally, with three pairs of pre-anal setae and two small, widely spaced pores caudolaterally to setae JV_2 . Para-anal setae almost in line with anterior margin of anal opening. Opisthogasteric cuticle with four pairs of short setae, seven pairs of small platelets, two pairs of slender metapodal shields and a long, slender platelet between the genital and ventro-anal shields.

Spermatheca (Figs 4-5): Major duct slender, atrium bulged with a constriction between it and the funnel-shaped cervix.

Gnathosoma (Fig. 6): Position of chelicerae render an examination impossible. Anterior margin of tectum dome-shaped.

Legs (Fig. 7): Legs without macrosetae. Genua II and IV both with eight setae (2-2/1, 2/0-1). Trochanter I bears six setae.

Male and immature stages: Unknown.

Affinities: *Typhlodromus charactus* is related to *T. ternatus* Ehara, 1972 and *T. alonguinensis* Chant, Hansell & Yoshida-Shaul, 1974, in having the dorsal shield setae short and three pairs of pre-anal setae. However, it differs from these two species in that genu IV bears eight setae, leg IV is devoid of macrosetae and in the shape of the spermatheca.

Remarks: This species was found together with *T. aenaulus* n. sp. and *Amblyseius lecodactylus* n. sp. (Phytoseiidae), *Bryobia praetiosa* C.L. Koch, 1836 and *Tetranychus* sp. (Tetranychidae), *Brevipalpus* sp. (Tenuipalpidae) and *Agistemus sanctiluciae* Meyer, 1969 (Stigmaeidae).

Etymology: The name of this species is derived from the Greek word "charaktos" which means "notched" referring to the deep incision in the dorsal shield opposite setae R_1 .

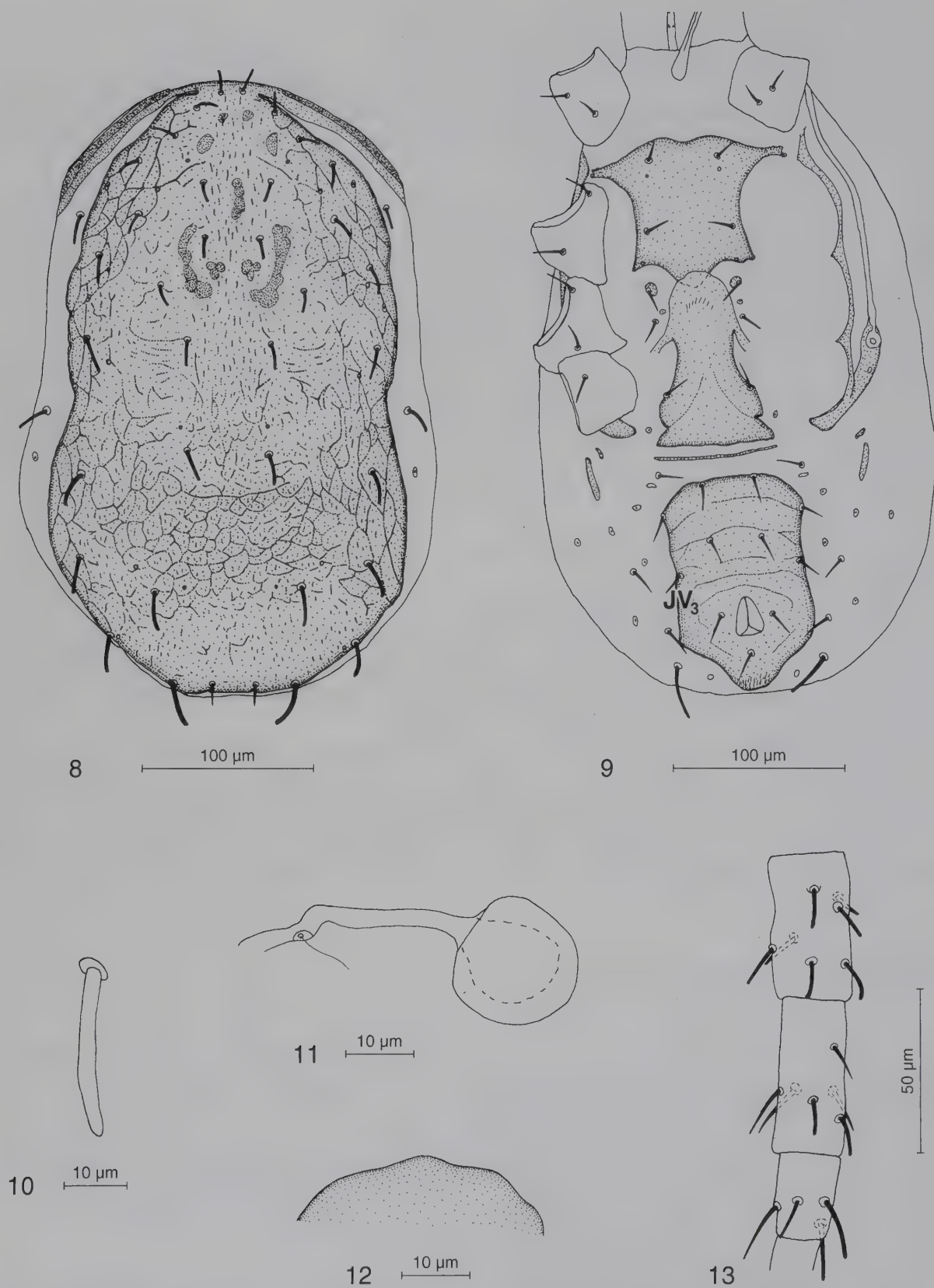
Typhlodromus adenensis n. sp. (Figs 8-13)

Holotype: ♀, Yemen: between Aden and Little Aden, ex unidentified plant, 10-12.IV.1993, A. van Harten, accession no. AcY 94/24, slide no. 1. — Paratype: 1 ♀, same data as holotype, slide no. 2.

Diagnosis: *Typhlodromus adenensis* can be recognised by the short, smooth, blunt-tipped dorsal shield setae and the absence of pre-anal pores on the ventro-anal shield. Dorsal and ventral setal patterns are 12A:8A and JV:ZV, respectively.

Description of female: Measurements of holotype (data for paratype in parentheses): length of body 387 (365); breadth 221 (189); length of sternal shield 88; breadth 76; breadth of genital shield 63 (72); length of ventro-anal shield 129 (126); breadth 85 (79); setae: j_1 25; j_3 and J_2 22 (19); j_4 and j_5 14 (13); r_3 , j_6 and S_4 20 (18); J_5 , z_3 and z_5 16 (15); z_2 13 (13); z_4 18 (16); Z_4 and Z_5 32 (28); s_6 , S_2 and S_4 26 (23); S_5 27; R_1 19 (16); JV_5 30 (25).

Dorsum (Fig. 8): Dorsal shield reticulated, with 18 pairs of smooth, blunt-tipped setae (Fig. 10), 11 pairs of pores and rugose patches. Setae r_3 and R_1 are situated on the interscutal membrane. Peritremes extending to level of setae j_1 .



Figs 8-13: *Typhlodromus adenensis* n. sp., ♀: 8, dorsum; 9, venter; 10, seta Z₅; 11, spermatheca; 12, anterior margin of tectum; 13, leg IV.

Venter (Fig. 9): Sternal shield with two pairs of setae and pores. Third pair of sternal pores on a small platelet, between third and fourth sternal setae, with third pair of sternal setae on small metasternal shields and fourth pair on the cuticle. Posterior margin of shield with a median lobe. Genital shield bears one pair of setae. Ventro-anal shield rectangular, slightly creased and with four pairs of pre-anal setae, but without pre-anal pores. Para-anal setae in line with middle of anal opening. Opisthogasteric cuticle with four pairs of setae, two pairs of metapodal shields, eight pairs of small, pore-bearing platelets and a long, slender platelet between the genital and ventro-anal shields. Setae JV₅ smooth and blunt-tipped.

Spermatheca (Fig. 11): Cervix tubular, separated from major duct by atrium.

Gnathosoma (Fig. 12): The position of the chelicerae renders an illustration impossible. However, the fixed digit has four teeth and a pilus dentilis and the movable digit two teeth. Anterior margin of tectum convex but slightly undulated.

Legs (Fig. 13): Legs without macrosetae, an indistinct macroseta may be present on basitarsus IV. Trochanter I bears six setae and genu II eight setae, 2-2/1, 2/0-1. Most of the leg setae are blunt-tipped.

Male and immature stages: Unknown.

Affinities: This species is similar to *T. drori* Grinberg & Amitai, 1970 and *T. longus* (Denmark & Knisley, 1978), but differs in having all the dorsal shield setae smooth and blunt-tipped and legs devoid of macrosetae. *Typhlodromus adenensis* further differs from *T. longus* in that the posterior margin of the sternal shield is lobed and the ventro-anal shield is without pre-anal pores.

Remarks: *Typhlodromus adenensis* was found together with a *Tetranychus* sp. (Tetranychidae) and a *Cheletacarus* sp. (Cheyletidae).

Typhlodromus aenaulus n. sp. (Figs 14-19)

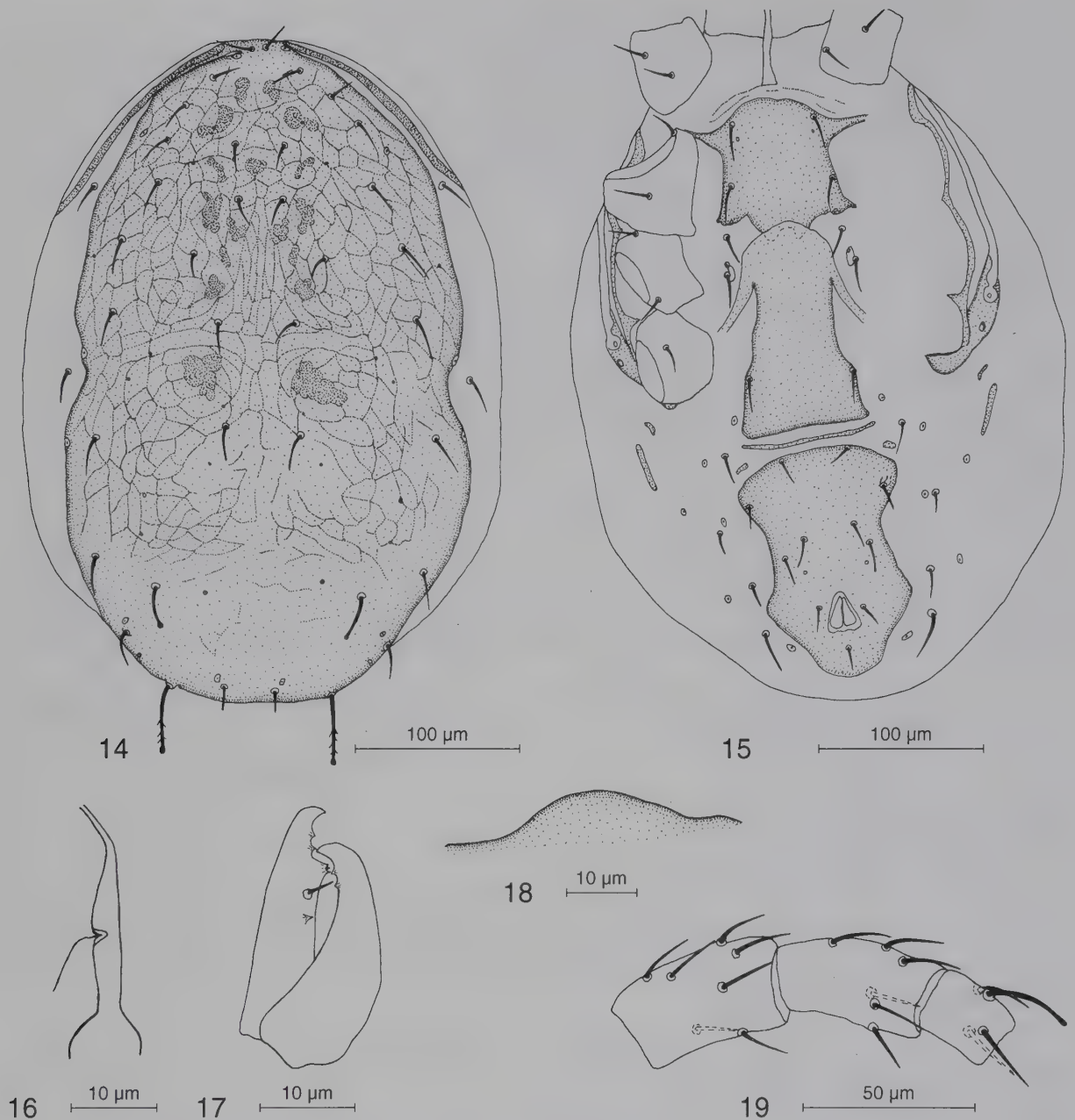
Holotype: ♀, Yemen: Wadi Udain, ex unidentified plant, 13.III.1993, A. van Harten, accession no. AcY 94/26, slide no. 1. — Paratypes: 4 ♀♀, same data as holotype, slide nos 2-5.

Diagnosis: Dorsal body setae short with setae Z₄ and Z₅ knobbed and Z₅ serrated, spermatheca with the cervix a broad tube that suddenly flares towards vesicle, leg V with one blunt or slightly knobbed macroseta on basitarsus, genu I with eight setae. Dorsal and ventral setal patterns are 12A:8A and JV:ZV, respectively.

Description of female: Measurements of holotype (data for paratypes in parentheses): length of body 384 (369-394); breadth 221 (211-227); length of sternal shield 88 (82-85); breadth 85 (79-85); breadth of genital shield 72 (72-82); length of ventro-anal shield 132 (132-151); breadth 95 (82-95); setae: j₁, z₂ and R₁ 19 (16-22); j₃, j₆, J₂, z₃, z₄, S₅ and r₃ 22 (22-25); j₄, j₅ and z₅ 16 (16-21); J₅ 13 (11-13); Z₄, s₄, s₆, S₂, S₄ and JV₅ 25 (25-28); Z₅ 41 (39-41); macroseta on basitarsus IV 22 (22-25).

Dorsum (Fig. 14): Dorsal shield broadly oval and reticulated. It bears 16 pairs of pores, rugose patches and 18 pairs of short, smooth setae, except for setae Z₄ and Z₅ which are knobbed; setae Z₅ are the longest and serrated. In one of the paratypes setae Z₄ are pointed. Setae r₃ and R₁ are on the interscutal membrane. Peritremes reach to level of setae j₁.

Venter (Fig. 15): Sternal shield with two pairs of setae and pores. Posterior margin with a median lobe which is convex in some paratypes and posteriorly indented in the holotype and a paratype. Third pair of sternal setae on cuticle, whereas fourth pair and third pair of pores are on small metasternal shields. Genital shield with one pair of setae. The ventro-anal shield is dilated anteriorly and across the anal opening. It is provided with four pairs of pre-anal setae and a pair of pre-anal pores immediately caudomedial to setae JV₄. Para-anal setae are anterior of middle of anal



Figs 14-19: *Typhlodromus aenaulus* n. sp., ♀: 14, dorsum; 15, venter; 16, spermatheca; 17, chelicerae; 18, anterior margin of tectum; 19, leg IV.

opening. Opisthogasteric cuticle bears four pairs of setae; ZV_1 , ZV_3 and JV_3 are short and setae JV_5 almost twice as long as the latter setae. Setae JV_5 are slightly knobbed in one of the paratypes, but otherwise pointed. Between the genital and ventro-anal shield lies a long slender platelet. The opisthogasteric cuticle further bears eight pairs of pore-bearing platelets and two pairs of metapodal plates.

Spermatheca (Fig. 16): Major duct originates as a slender tube, but suddenly broadens and forms a broad tube together with the cervix which suddenly flares towards the vesicle. The lips of the atrium separate between major duct and cervix.

Gnathosoma (Figs 17-18): The fixed cheliceral digit bears six teeth, of which three are on an evagination, and a pilus dentilis. The movable digit has two teeth. The anterior margin of the tectum is as figured in Fig. 18.

Legs (Fig. 19): Chaetotaxy of the legs is normal, except for trochanter I bearing six setae and genu II eight setae, 2-2/1, 2/0-1. Leg IV bears a single macroseta on the basitarsus which varies from being pointed, slightly knobbed to knobbed.

Male and immature stages: Unknown.

Affinities: This species is unique but resembles *T. hebetis* (De Leon, 1959) in the shape of the spermatheca.

Remarks: *Typhlodromus aenaulus* was found in association with the same mite species as *T. charactus* n. sp.

Etymology: The name "aenaulus" refers to a Wadi or dry river bed (type locality) and is a combination of: "a-" Latin for "from" and "enaulos" the Greek for "stream-bed."

Typhlodromus praeacutus Van der Merwe, 1968

Typhlodromus praeacutus Van der Merwe, 1968. — Ent. Mem. 18: 53.

Material: Yemen: Sana'a, ex *Chamaecyparis* sp., 29.X.1991, A. van Harten; between Ta'izz and Al Mukha, ex unidentified plant, 15.III.1993, A. van Harten.

Diagnosis: Dorsal shield setae become progressively longer towards rear, setae Z_4 and Z_5 are the longest and serrated; setae S_5 much shorter than S_4 ; cervix of spermatheca a rather broad tube with atrium incorporated in it; leg II with eight setae, 2-2/1, 2/0-1; leg IV with one macroseta on basitarsus, knobbed or pointed.

Remarks: The following mites were found in association with *T. praeacutus*: Anystidae (probably a new genus); *Caeculus* sp. (Caeculidae); *Molothrognathus phytocolus* Meyer & Uecker-mann, 1989 (Caligonellidae); *Amblyseius desertorum* (Amitai & Swirski, 1978) (Phytoseiidae); *Sphaerolophus* sp. (Erythraeidae); *Dolichotetranychus* sp. (Tenuipalpidae); *Eutetranychus orientalis* (Klein, 1936), *Neopetrobia* sp., *Oligonychus ununguis* (Jacobi, 1905) and *Tetranychus* sp. (Tetranychidae).

Distribution: Cape Verde Islands and South Africa.

Typhlodromus persianus McMurtry, 1977

Typhlodromus persianus McMurtry, 1977. — Ann. Ent. Soc. Am. 70 (4): 563.

Material: Yemen: A. van Harten, no further data given.

Diagnosis: This species is similar to *T. praeacutus* Van der Merwe, 1968 but differs from the latter in that setae Z_4 are shorter than distance to Z_5 , setae Z_5 are knobbed and genu II bears seven setae, 2-2/0, 2/0-1.

Remarks: The plant on which *T. persianus* was found, was infested with *Acalitus hassani* Keifer, 1973 (Eriophyidae). Eriophyids are in most cases host specific, and if this is the case, *A. hassani* and *T. persianus* could have been collected from *Salvadora persica*. *Acalitus hassani* was described from the latter plant in Sudan (KEIFER 1974).

Distribution: Cape Verde Islands and Iran.

Iphiseius degenerans (Berlese, 1889)

Seius degenerans Berlese, 1889. — Tipografia del Seminario, Padova, V. VI 54: 9.

Iphiseius degenerans. — Berlese 1921; Redia 14 (1-2): 95.

Material: Yemen: Sana'a, ex *Hibiscus rosasinensis*, 25.XI.1992, H. Mahdi; in vicinity of Medinat Al Shirq, ex unidentified plant, 7.III.1993, A. van Harten; Ta'izz, ex *Citrus* sp., 16.II.1993, M. Knapp.

Diagnosis: The species of this genus are unique in that the interscutal membrane is sclerotised, otherwise *Iphiseius* is similar to *Amblyseius* Berlese. *Iphiseius degenerans* can be easily distinguished from other species in this genus by having all the dorsal shield setae short, with setae j_1 and Z_5 slightly longer and the ventro-anal shield divided in both the male and the female.

Remarks: The following species were found together with this species: *Caeculus* sp. (Caeculidae); *Abrolophus* sp., *Sphaerolophus* sp., *Parerythraeus* sp., *Bochartia* sp. and *Leptus* sp. (Erythraeidae); Oribatei; *Amblyseius nyalensis* Elbadry, 1968 (Phytoseiidae); *Eryngiopus yemenensis* Van Dis & Ueckermann, 1993 and *Agistemus fleschneri* Summers, 1960 (Stigmaeidae); *Eutetranychus orientalis* (Klein, 1936) and *Panonychus citri* (McGregor, 1916) (Tetranychidae).

Distribution: Cosmopolitan.

***Amblyseius desertorum* (Amitai & Swirski, 1978) n. comb.**

Phytocerus desertorum Amitai & Swirski, 1978. — Israel J. Ent. 12: 125.

Material: Yemen: between Ta'izz and Al Mukha, ex unidentified plant, 15.III.1993, A. van Harten.

Diagnosis: This species is unique in that the dorsal shield setae are set on tubercles and are blunt distally and in that the dorsal shield bears "wax plates". The major duct and cervix of the spermatheca form together a long slender tube, but the cervix suddenly flares towards the vesicle to form a shallow dome. The vase-shaped ventro-anal shield is narrow anteriorly and wide across the anal opening. Macrosetae on leg IV are indistinct.

Remarks: This species was found together with *Molothrognathus phytocolus* Meyer & Ueckermann, 1989 (Caligonellidae); Anystidae (probably a new genus); *Caeculus* sp. (Caeculidae); *Sphaerolophus* sp. (Erythraeidae); *Typhlodromus praeacutus* Van der Merwe, 1968 (Phytoseiidae); *Eutetranychus orientalis* (Klein, 1936), *Neopetrobia* sp. and *Tetranychus* sp. (Tetranychidae).

Distribution: Palestine.

***Amblyseius nyalensis* Elbadry, 1968 (Figs 20-28)**

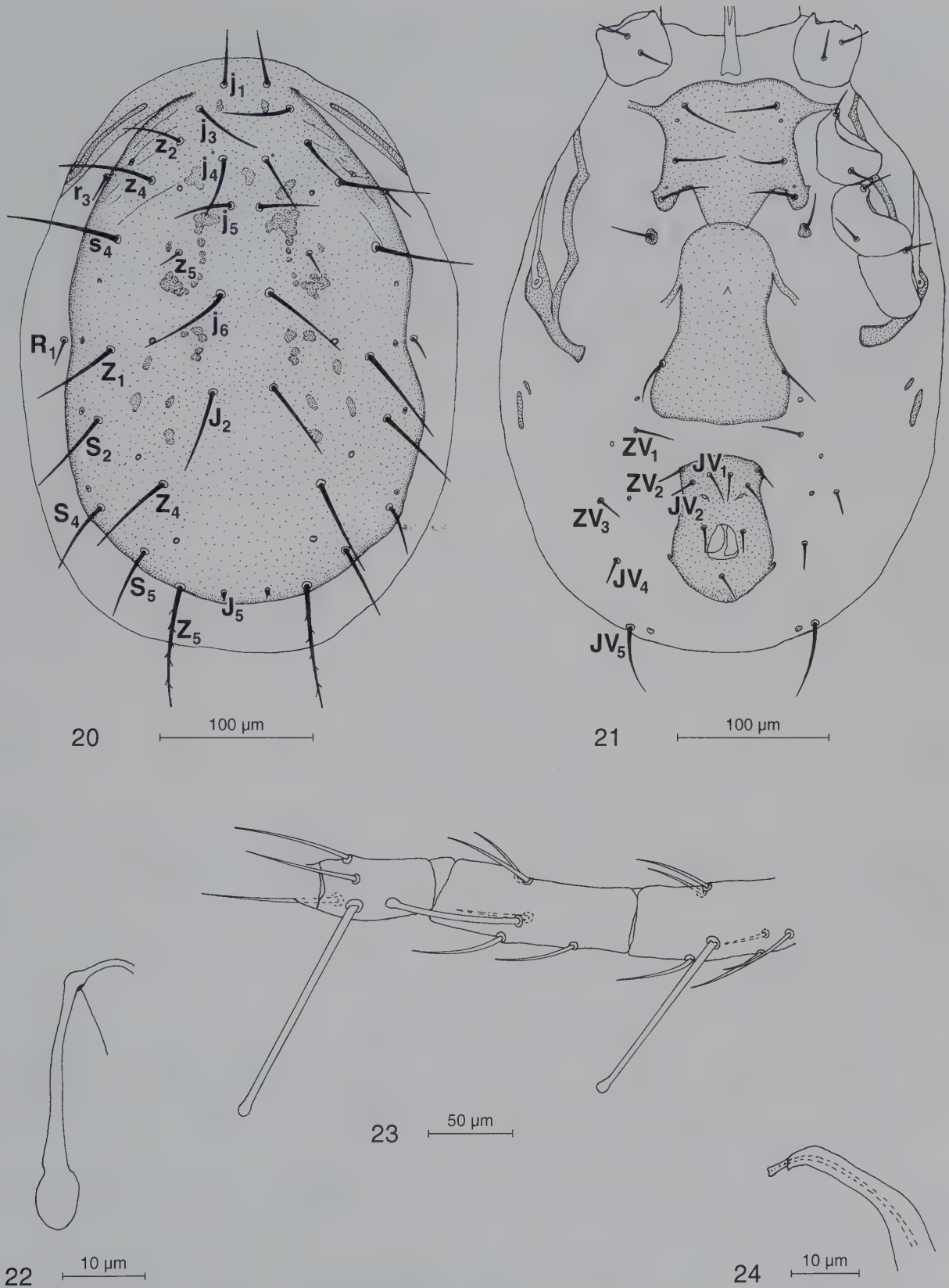
Amblyseius nyalensis Elbadry, 1968. — Rev. zool. bot. afr. 77 (3-4): 322.

Material: Yemen: 1 ♀, Ta'izz, ex *Citrus* sp., 16.II.1993, M. Knapp; 2 ♀♀, 1 protonympha, Ta'izz, ex *Coffea* sp., 17.II.1993, M. Knapp; 1 ♂, 1 deutonympha, Ta'izz, ex *Mangifera* sp., 16.II.1993, M. Knapp.

Diagnosis: All dorsal shield setae are long and smooth, except for setae z_5 and J_5 which are much shorter and setae Z_5 which are slightly serrated; atrium of spermatheca slightly bulged, with cervix a slender tube which gradually widens towards the vesicle; macrosetae on legs blunt (genu I) or knobbed distally (legs II-IV).

The specimens from Yemen clearly correspond to the description of this species, except for setae Z_5 which are serrated and not smooth as indicated by ELBADRY (1968). The following re-description of this species is based on the Yemeni specimens because the original description lacks details of some characters of the female and male. Two immature stages are described here for the first time. The dorsal and ventral setae patterns of the idiosoma are 10A:9B and JV-3:ZV, respectively.

Description of female: Measurements (data for holotype, taken by E.A. Elbadry, in parentheses): length of body 324-378 (330); breadth 211-221 (145); length of sternal shield 91-95; breadth 91-101; breadth of genital shield 88-98; length of ventro-anal shield 95-113; breadth 69-79; setae: j_1 33-35 (37); j_3 46-47 (45); j_4 28-35 (37); j_5 38-41 (45); j_6 54-59 (62); J_2 54-57 (60); J_5 4; z_2 38 (37); z_4 52-54 (52); z_5 13-14 (17); Z_1 54-55 (55); Z_4 47-57 (57); Z_5 and s_4 71-72 (75); S_2 54-58 (60); S_4 38-44 (47); S_5 38-41 (42); r_3 22-24; R_1 19; JV_5 41-47; macrosetae: genu I 32-33 (30); genu II 30-32 (27); genu III 41 (35); tibia III 28-30 (30); genu IV 59-60; tibia IV 38-39 (45); basitarsus IV 66-67 (65).



Figs 20-24: *Amblyseius nyalensis*. 20, dorsum of female; 21, venter of female; 22, spermatheca; 23, leg IV of female; 24, spermatheca.

Dorsum (Fig. 20): Dorsal shield ovoid and smooth except for a few imbrications anterolaterally, rugose patches and ten pairs of pores. The shield bears 17 pairs of long setae, except for setae z_5 and J_5 which are much shorter. Setae Z_5 are slightly serrated. Peritremes extending to level of setae j_3 .

Venter (Fig. 21): Sternal shield with three pairs of setae and two pairs of pores. Posterior margin with two lateral lobes and a median wedge-shaped lobe. Fourth pair of sternal setae on small metasternal shields. Genital shield normal for the Phytoseiidae. Ventro-anal shield narrow anteriorly and wide across anal opening, bearing three pairs of pre-anal setae in an almost straight line and a pair of crescent-shaped pores posteriad of setae JV_2 . Para-anal setae almost in line with anterior margin of anal opening. Opisthogasteric cuticle with four pairs of setae, two pairs of metapodal shields and four pairs of small platelets. Setae JV_5 the longest and smooth.

Spermatheca (Fig. 22): Cervix a slender tube which gradually widens before it joins the vesicle. Atrium slightly bulged.

Gnathosoma: Anterior margin of tectum could not be observed and the position of the chelicerae render an examination impossible.

Legs (Fig. 23): Leg chaetotaxy normal for Phytoseiidae. Macrosetae distributed as follows: genu I (blunt distally), genua II, III and IV, tibiae III and IV and basitarsus IV (all knobbed distally).

Description of male: Measurements (data for ♂ paratype in parentheses): length of body 261 (263); breadth 180 (165); length of sternogenital shield 128; breadth 110; length of ventro-anal shield 98; breadth 161; setae: j_1 and S_5 28; j_3 , J_2 and Z_4 38; j_4 23; j_5 26; j_6 and Z_1 41; J_5 3; z_2 30; z_4 43; z_5 11; z_2 30; Z_5 50; s_4 55; S_2 45; S_4 27; r_3 21; R_1 13; JV_5 32; macrosetae: genu I 32; genu II 30; genu III 37; tibia III 25; genu IV 50; tibia IV 33; basitarsus IV 60.

Dorsum: The dorsal shield differs from that of the female in that setae r_3 and R_1 are inserted on the shield, six pairs of pores are present and the peritremes are shorter, reaching to the level of setae z_4 . According to ELBADRY (1968) setae r_3 and R_1 are on the interscutal membrane. The dorsal setal pattern of the dorsum is the same as in the female.

Venter: Sternogenital shield bears five pairs of setae, two pairs of pores and the genital opening is situated on its anterior margin. Ventro-anal shield slightly reticulated anteriorly and fused with peritrematal shields. It has three pairs of pre-anal setae in an almost straight line and two pores. Opisthogasteric cuticle with setae JV_5 and two pairs of small platelets. The ventral setal pattern is $JV-3$, $4:ZV-1$, 3 .

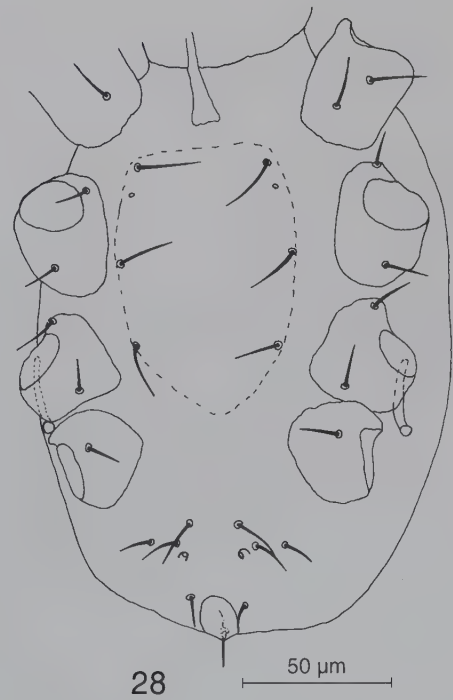
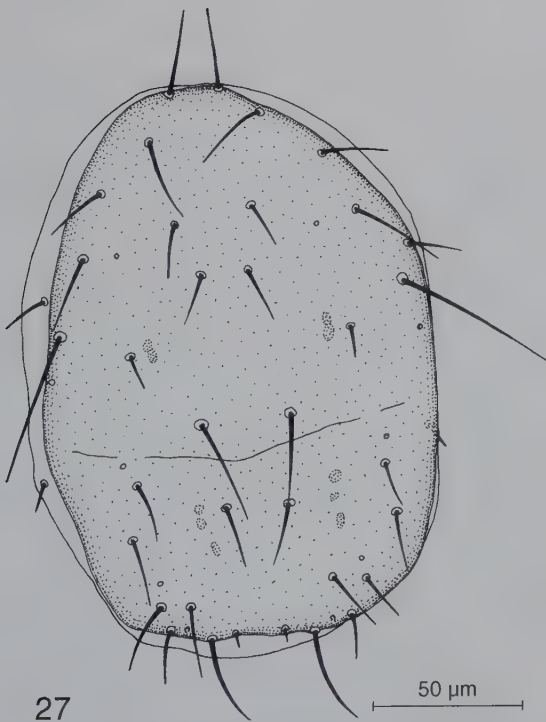
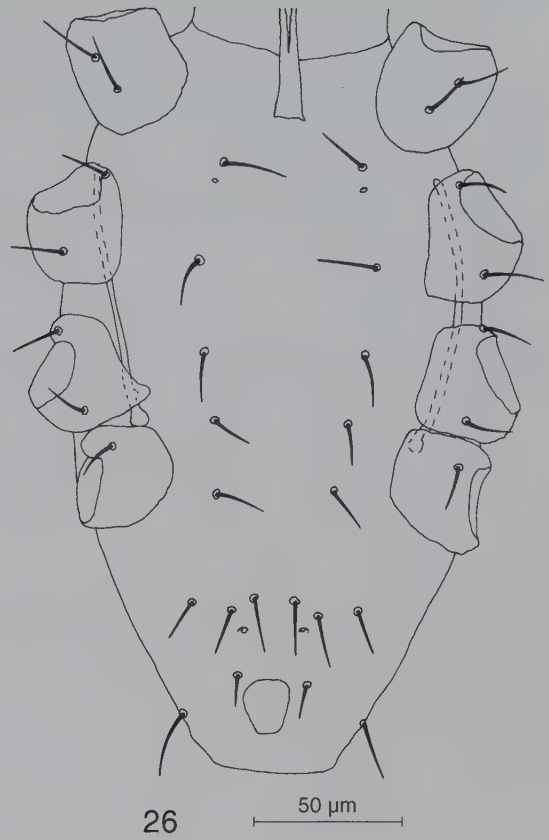
Gnathosoma (Fig. 24): Anterior eighth of spermadactyl very slender, with a small lateral process where the slender part begins.

Legs: Distribution and shape of macrosetae similar to those of female.

Description of male deutonympha: Measurements: length of body 258; breadth 135; setae: j_1 and S_5 28; j_3 , J_2 , Z_1 and Z_4 38; j_4 24; j_5 26; j_6 and S_2 41; J_5 3; z_2 32; z_4 44; z_5 and R_1 13; Z_5 55; s_4 58; S_4 29; r_3 22; JV_5 25; macrosetae: genu I 32; genu II and tibia III 28; genu III and tibia IV 38; genu IV 50 and basitarsus IV 61.

Dorsum (Fig. 25): Dorsal shield with 17 pairs of setae, four pairs of pores and a few rugose patches. Setae Z_5 are serrated. Peritrematal shields absent and peritremes extending to just anterior of coxae II.

Venter (Fig. 26): Ventral shields indistinctly outlined. Sternal shield with five pairs of setae and a pair of pores. Opisthogaster with three pairs of pre-anal setae, almost aligned transversely, two pre-anal pores and an anal opening. Para-anal setae slightly anterior of anterior margin of anal opening. The absence of setae ZV_1 , ZV_3 and JV_4 is characteristic of male deutonymphs.



Figs 25-28: *Amblyseius nyalensis*. 25, dorsum of deutonympha; 26, venter of deutonympha; 27, dorsum of protonympha; 28, venter of protonympha.

Legs: Chaetotaxy similar to that of adults. Macroseta on genu I is pointed, whereas all the other macrosetae are knobbed distally.

Description of protonympha: Measurements: length of body 195; breadth 129; setae: j_1 30; j_3 32; j_4 16; j_5 and Z_5 38; J_2 and Z_1 20; J_5 6; z_2 and Z_4 25; z_4 36; z_5 14; s_4 54; S_2 22; S_4 and S_5 19; r_3 14; R_1 9; JV_5 19; macrosetae: genu I ?; genu II 28; genu III 38; tibia III 30; genu IV 52; tibia IV 53 and basitarsus IV 65.

Dorsum (Fig. 27): Dorsal shield provided with 17 pairs of setae and five pairs of pores. Shield apparently not divided, but with a fold behind setae j_6 . Peritrematal shields absent, peritremes very short.

Venter (Fig. 28): Outline of sternal shield vaguely visible, bearing three pairs of setae and a pair of pores. Opisthogaster with anal opening, three pairs of pre-anal setae and two pre-anal pores.

Legs: Chaetotaxy of legs as follows: coxae similar to that of adults; trochanters each with four setae; femur I, 2-2/2, 2/1-1; femur II, 1-2/1, 2/0-1; femur III, 1-1/1, 2/0-0; femur IV, 1-2/0-1; genu I and tibia I, 1-2/1, 2/1-1; genu II-III, 1-2/0, 2/0-1; genu IV, 1-2/, 2/0-0; tibia II-III, 1-1/1, 2/1-1; tibia IV 1-1/1, 2/0-1. Macroseta on genu I indistinct. The rest of the macrosetae are all knobbed distally.

Affinities: *Amblyseius nyalensis* is very closely related to *A. tutsi* Pritchard & Baker, 1962, but differs from the latter species in that setae s_4 and Z_5 of the female are equal in length and all the macrosetae are knobbed distally.

Remarks: The following mite species were collected together with *A. nyalensis*: *Eupodes* sp. (Eupodidae); *Agistemus fleschneri* Summers, 1960 (Stigmaeidae); *Iphiseius degenerans* (Berlese, 1889) (Phytoseiidae); Oribatei; *Eotetranychus* sp., *Panonychus citri* (McGregor, 1916) and *Eutetranychus orientalis* (Klein, 1936) (Tetranychidae); *Tydeus* sp. (Tydeidae).

Distribution: Sudan.

Amblyseius lecodactylus n. sp. (Figs 29-33)

Holotype: ♀, Yemen: Wadi Udain, ex unidentified plant, 13.III.1993, A. van Harten, accession no. AcY 94/27, slide no. 1. — Paratype: 1 ♂, same data as holotype, slide no. 2.

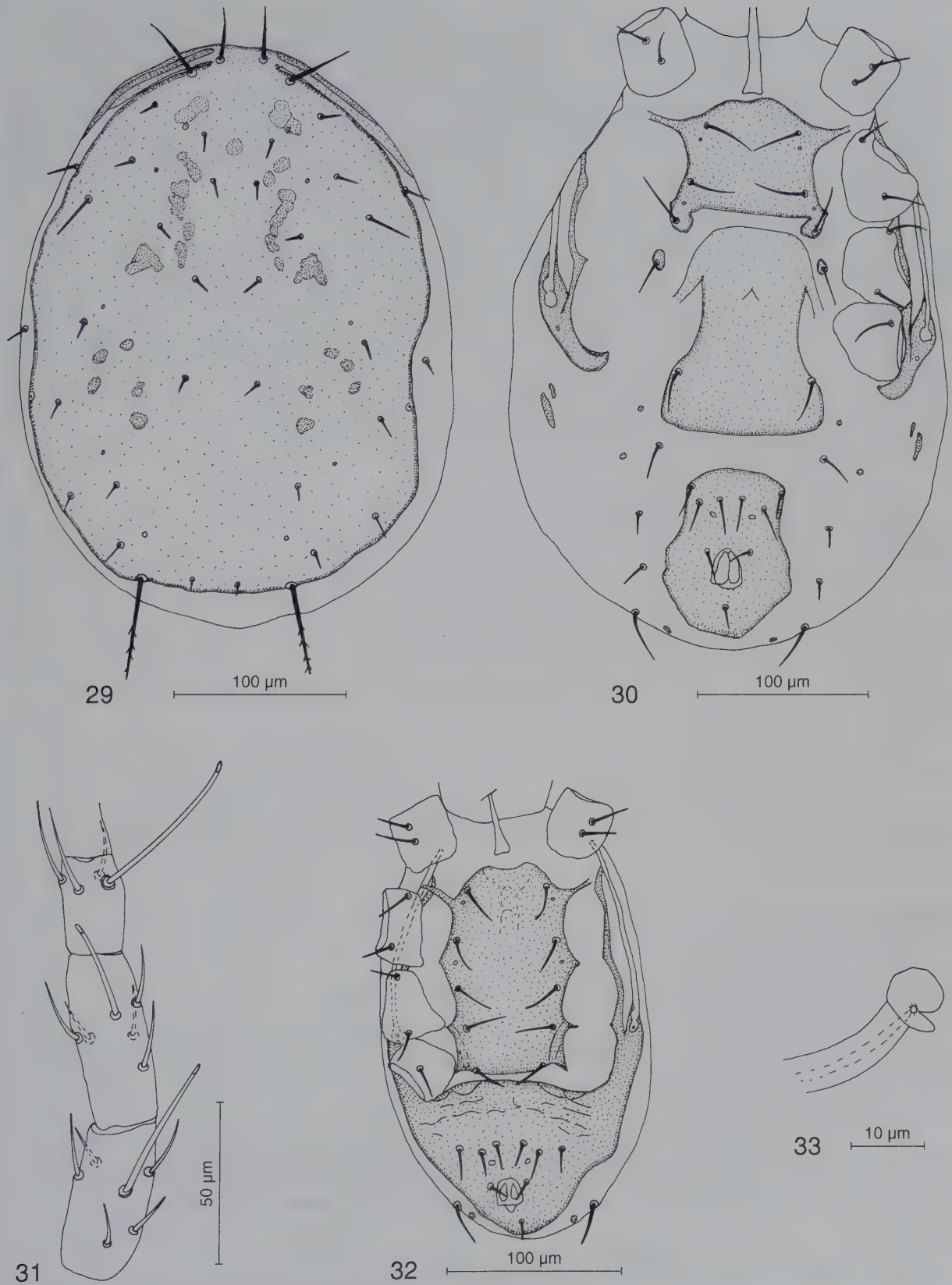
Diagnosis: Dorsal shield setae j_1 , j_3 , s_4 , and Z_5 distinctly longer than rest of setae on the shield, pre-anal setae almost aligned and spermadactyl of male with a deeply incised, bowl-shaped structure distally. Dorsal and ventral setal patterns are 10A:9B and JV-3:ZV, respectively.

Description of female: Measurements of holotype: length of body 315; breadth 217; length of sternal shield 76; breadth 88; breadth of genital shield 95; length of ventro-anal shield 95; breadth 72 across anal opening; setae: j_1 32; j_3 41; j_4 and Z_1 11; j_5 , j_6 and z_5 9; J_2 , Z_4 , S_2 , S_4 and S_5 13; J_5 6; z_2 and z_4 16; Z_5 57; s_4 (missing); r_3 16; R_1 11; JV_5 38; macrosetae: genu II 22; genu III 28; genu IV 46; tibia IV 30 and basitarsus IV 52.

Dorsum (Fig. 29): Dorsal shield broadly oval, smooth with 17 pairs of setae, six pairs of pores and rugose patches. Setae r_3 and R_1 are on the interscutal membrane. All the dorsal body setae are smooth, except for Z_5 . Peritremes extending anterolaterad of setae j_1 .

Venter (Fig. 30): Sternal shield provided with three pairs of setae and two pairs of pores. Posterior margin straight, with small lobes laterally. Fourth pair of sternal setae on small platelets. Genital shield normal for Phytoseiidae. Ventro-anal shield has three pairs of pre-anal setae arranged in an almost straight line and a pair of pre-anal pores. Para-anal setae in line with anterior margin of anal opening. Opisthogasteric cuticle with four pairs of setae and two pairs of metapodal shields. Only three pairs of small platelets are perceptible. Setae JV_5 are smooth and simple.

Spermatheca: The position of the spermatheca renders an illustration impossible.



Figs 29-33: *Amblyseius lecodactylus* n. sp.: 29, dorsal shield of female; 30, venter of female; 31, leg IV; 32, venter of male; 33, spermadactyl.

Gnathosoma: The chelicerae and anterior margin of the tectum could not be examined.

Legs (Fig. 31): Chaetotaxy normal for Phytoseiidae. Macrosetae present on genua II-IV and tibia and basitarsus IV. Macrosetae on leg IV have hyaline tips.

Description of male: Measurements: length of body 255; breadth 148; length of sternogenital shield 126; breadth 79; length of ventro-anal shield 91; breadth 131; setae: j_1 25; j_3 35; j_4 , j_5 , j_6 , J_2 , z_5 , Z_1 and R_1 9; J_5 4; z_2 , z_4 , Z_4 , S_2 and S_4 11; Z_5 47; s_4 28; S_5 10; r_3 13; JV_5 25; macrosetae: genu II 18; genu III 22; genu IV 32; tibia IV 25; basitarsus IV 38.

Dorsum: Dorsal setal pattern same as in female. Dorsal shield differs from that of female in that setae r_3 and R_1 are situated on the shield and the peritremes are shorter, reaching to the level of setae z_2 . Setae Z_5 slightly serrated. Dorsal setal pattern similar to that of female.

Venter (Fig. 32): Sternogenital shield bears five pairs of setae, two pairs of pores and the genital opening on anterior margin. Ventro-anal shield faintly reticulated anteriorly and laterally fused with the peritrematal shields. It bears three pairs of pre-anal setae, arranged in an almost straight line, and two pores. Para-anal setae positioned as in female. Opisthogasteric cuticle with setae JV_5 and two pairs of small platelets. Ventral setal pattern as follows: $JV-3$, 4: $ZV-1$, 3.

Gnathosoma (Fig. 33): Spermadactyl with a deeply incised bowl-shaped structure distally.

Legs: Distribution and shape of macrosetae as in female.

Affinities: This species belongs to a group of species having setae j_1 , j_3 , s_4 and Z_5 much longer than the rest of the dorsal shield setae and the pre-anal setae in an almost straight line. *Amblyseius concordis* (Chant, 1959), *A. naindaime* Chant & Baker, 1965, *A. vivax* Chant & Baker, 1965, *A. caseariae* De Leon, 1967, *A. haramotoi* Prasad, 1968 and *A. victoriensis* (Womersley, 1954) are the closest related to *A. lecodactylus*. Besides differences in setal lengths, presence or absence of macrosetae on podomeres of legs I-III, the shape of the ventral shields and macrosetae on leg IV, *A. lecodactylus* mainly differs from these species by having longer peritremes and by the shape of the spermadactyl of the male.

Remarks: This species was found in association with the same mite species as *Typhlodromus aenaulus* n. sp. and *T. charactus* n. sp.

Etymology: The name "lecodactylus" is a combination of two Greek words, namely "leko" meaning "basin" or "pan" and "dactylos" meaning "finger" and refer to the bowl-shaped structure of the spermadactyl.

Amblyseius barkeri (Hughes, 1948)

Neoseiulus barkeri Hughes, 1948. — Mites assoc. food prod. (Phytoseiidae): 142.

Amblyseius barkeri. — Athias-Henriot 1961; Acarologia 3 (4): 440.

Material: Yemen: Medinat Al Shirq, ex *Coffea* sp., 10.II.1993, A. van Harten.

Diagnosis: This species can be recognised by the relatively short dorsal shield setae, except for setae Z_4 and Z_5 ; spermatheca with broad major duct, bifid atrium and almost tube-like cervix, which may be slightly bulged before it joins the atrium; ventro-anal shield of male with four pairs of pre-anal setae.

Remarks: *Amblyseius barkeri* was found in association with *Anystis baccarum* (Linnaeus, 1758) (Anystidae); *Proctolaelaps* sp. (Ascidae); *Bdellodes longirostris* (Hermann, 1804) (Bdellidae); *Leptus* sp. (Erythraeidae); *Eupodes* sp. (Eupodidae); *Brevipalpus obovatus* Donnadieu, 1875 (Tenuipalpidae).

Distribution: Cosmopolitan.

Amblyseius swirskii Athias-Henriot, 1962

Amblyseius swirskii Athias-Henriot, 1962. — Ann. Ec. Nat. Agr. Alg. 3 (5): 1-7.

Amblyseius swirskii. — Ueckermann 1992; *Phytophylactica* 24: 153.

Material: Yemen: Ta'izz, ex *Citrus* sp., 16.II.1993, M. Knapp.

Diagnosis: This species differs from the closely related *A. andersoni* (Chant, 1957) in that setae Z_5 are much shorter (100-126 as opposed to 145-163 in *A. andersoni*) and in the shape of the minor duct of the spermatheca; the minor duct originates from the atrium as a very slender duct but suddenly broadens and gradually narrows again, whereas it is slender throughout its length in *A. andersoni*. The major duct of *A. swirskii* is also relatively broader than that of *A. andersoni*.

Remarks: This species was found in association with: *Iphiseius degenerans* (Berlese, 1889) (Phytoseiidae); Oribatei; *Panonychus citri* (McGregor, 1916), *Eutetranychus orientalis* (Klein, 1936) (Tetranychidae); *Agistemus fleschneri* Summers, 1960 (Stigmaeidae).

Distribution: Cape Verde Islands and Palestine.

ACKNOWLEDGEMENTS

I wish to thank Mr A. van Harten and Mr. M. Knapp of the Yemeni-German Plant Protection Project for providing the material used in this study, Dr. M.K.P. Smith Meyer for reviewing the manuscript and Mrs. J.C.S. van Dis for her assistance in the mounting of the specimens.

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Large Branchiopods (Crustacea: Anostraca, Notostraca, Spinicaudata, Laevicaudata) from Temporary Inland Waters of the Arabian Peninsula

Alain Thiéry

Abstract: A taxonomic and faunistic account is given of the large Branchiopods, previously "phyllopods", (Anostraca, Notostraca, Spinicaudata, Laevicaudata) of the Arabian Peninsula. It is based on the identification of more than 1000 specimens collected from temporary inland waters (63 pools) in Saudi Arabia (1959-1992), Oman (1982-1995), Syria (1977, 1980) and Yemen (1990). Data from the literature is included in the survey. Nineteen species are listed, with 15 on the Arabian Peninsula and four in Syria. The adults, male and female, and the encysted gastrula stage (= cyst) of the collected species are illustrated using scanning micrographs and drawings. The cyst shell morphology and diameter appear to be species- or genus-specific and useful for systematic purposes.

A zoogeographical analysis reveals an arid African affinity in the central area of the peninsula, with the presence of an association *Triops numidicus* – *Branchipus schaefferi* – *Leptestheria mayeti* – *Tanymastigites cyrenaica* which is frequent and common in the northern Sahara. The desert fauna shows purely Ethiopian relationships and, apart from eurytopic species such as *Branchipus schaefferi*, contains no Palaearctic element. It is the westernmost extension of the fauna of Saharan Africa. On the western border of the Arabian desert, in the Highlands near the Red Sea, a streptocephalid may represent a natural hybrid between the Palaearctic *Streptocephalus torvicornis* occurring in northern Yemen and the Saharan species *S. rubricaudatus*. The south of the Arabian Peninsula, isolated from the desert by mountains, presents both influences: in northern Yemen we find Palaearctic species such as *Triops cancriformis simplex* associated with *Streptocephalus torvicornis*, in southern Yemen we find more Asian and Afrotropical elements (*Streptocephalus simplex*, genera *Eulimnadia*, *Lynceus*) with some degree of endemism, particularly in the mountains of Yemen and in Oman (*Branchipodopsis* n. sp.). Salty waters in the Arabian Peninsula are represented by two known species, *Artemia* sp. and *Branchinella spinosa*. They are present in western Saudi Arabia (Dhahran, Jubail) and in the Wahiba Sands of Oman, respectively. In Syria the major affinity is Mediterranean and Palaearctic with the genera *Lepidurus*, the *Chirocephalus* 'diaphanus group' and *Cyzicus*. The discussion considers the ecological requirements of "large branchiopod" species.

غَلْصِمِيَّاتُ الْأَرْجُلِ الْكَبِيرَةِ

(صنف القشريات : Anostraca, Notostraca, Spinicaudata, Laevicaudata)

من المياه الداخلية المؤقتة في شبه الجزيرة العربية

آلان تييري

خلاصة : يتضمن هذا البحث عرض تصنيفي لغلصميات الأرجل الكبيرة والمسماة سابقاً "phyllopods" في شبه الجزيرة العربية وهي : Laevicaudata, Spinicaudata, Notostraca, Anostraca. يستند هذا البحث على تشخيص لأكثر من ١٠٠٠ عينة تم جمعها من تجمعات المياه الداخلية المؤقتة وعددها ٦٣ في كل من المملكة العربية السعودية (١٩٥٩-١٩٩٢)، عُمان (١٩٨٢-١٩٩٥)، سوريا (١٩٧٧ و ١٩٨٠)، واليمن (١٩٩٠). كما يتضمن هذا المسح معلومات مستقاة من المراجع. وقد تم جدولة ١٩ نوعاً، ١٥ منها من شبه الجزيرة العربية و ٤ أنواع من سوريا. يحتوي البحث على صور بالتصوير المجهرى الماسح الدقيق ورسوم للذكور والاناث البالغة وكذلك المراحل الجنينية المبكرة (الحويصلة) للأنواع التي تم جمعها. يبدو إن شكل وقطر قشرة الحويصلة يعتبر مميزاً للأنواع أو الأجناس ويساعد في عملية التصنيف. نتيجة لتحليل المعلومات الخاصة بالتوزيع الجغرافي لهذه

الحيوانات تبين وجود علاقة بين المنطقة الوسطى من شبه الجزيرة العربية وبين المناطق الأفريقية القاحلة ووجود تجمعات الانواع التالية : *Tanymastigites cyrenaica* و *Triops numidicus* - *Branchipus schaefferi* - *Leptestheria mayeti* وبصورة شائعة في الجزء الشمالي من الصحراء الافريقية. تظهر المجموعة الحيوانية الصحراوية صلات واضحة بالمجموعة الأثيوبية فيما عدا الأنواع الواسعة الانتشار مثل *Branchipus schaefferi*، التي ليس لها أي علاقته بالمنطقة القطبية القديمة. وهي تمثل الحد الغربي الأقصى لانتشار مجموعة حيوانات الصحراء الأفريقية. وفي الطرف الغربي للصحراء العربية وفي المرتفعات قرب البحر الأحمر يمثل streptocephalid الهجين الطبيعي بين النوع القطبي القديم *Streptocephalus torvicornis* الذي يوجد في شمال اليمن وبين النوع الصحراوي *Streptocephalus rubricaudatus*. إن منطقة جنوب شبه الجزيرة العربية والمعزولة عن الصحراء بسلسلة من الجبال تمثل تأثير الجهتين : حيث يوجد في شمال اليمن أنواع من المنطقة القطبية القديمة مثل *Triops cancriformis simplex* التي توجد مع النوع *Streptocephalus torvicornis* - وفي جنوب اليمن يغلب وجود العناصر الآسيوية والأفريقية الأستوائية مثل : النوع *Streptocephalus simplex* والجنسان *Eulimnadia* و *Lynceus* مع وجود بعض الأنواع المستوطنة وخاصة في جبال اليمن وعمان مثل *Branchipodopsis* n. sp. أما أنواع المياه المالحة في شبه الجزيرة العربية فتتمثل بالنوعين *Artemia* sp. و *Branchinella spinosa* اللذان يوجدان في غرب وجنوب المملكة العربية السعودية (الظهران - الجليل) وفي منطقة رمال الوهبة في عُمان على التوالي. وبالنسبة لسوريا فإن العلاقة الرئيسية هي مع انواع البحر الأبيض المتوسط والمنطقة القطبية القديمة مثل الاجناس *Lepidurus* ومجموعة *Chirocephalus diaphanus* و *Cyzicus*. وتناول المناقشة الاحتياجات البيئية لأنواع غلصميات الأرجل الكبيرة.

INTRODUCTION

The fauna of Saudi Arabia and more widely, of the Arabian Peninsula, including such northern countries as Syria and Iraq, have attracted the attention of biologists to the study of terrestrial invertebrates and vertebrates but rarely to freshwater invertebrates. Up to date, little is known about the branchiopod fauna (Anostraca, Notostraca, Spinicaudata and Laevicaudata) of its temporary inland waters. The first references to "phyllopods" in the Arabian Peninsula, from the end of the last century to the beginning of the present, refer to its northern and western neighbours, i.e. Palestine, Syria, Iraq, (BAIRD 1859, 1862; COSTA 1875; BARROIS 1892; DADAY 1910, 1914; GURNEY 1921), or to the south of the peninsula, in Yemen (BOND 1934) and Oman (HARDING 1941). However, samples were often more or less isolated and most specimens came from Museum collections, so that the richness and diversity of the Levant and the Arabian Peninsula remained poorly known. More recently, several authors studied associations of Anostraca from Palestine (YARON 1964, DIMENTMAN 1981) and described new Spinicaudata from Iraq (DURGA PRASAD et al. 1981, MOHAMMAD 1985). One Anostraca species was collected from Jordan by MURA & COTTARELLI (1985) and many Notostraca were collected in Oman by BÜTTIKER & BÜTTIKER (1988) but remained unidentified.

This paper attempts to describe the zoological and biogeographical situation on the basis of all records made since the early twentieth century. It also suggests factors that may have determined the faunal pattern currently displayed.

Abbreviations

- BMNH: The Natural History Museum, London
- KAAD: Kerosene (30 %), Absolute ethanol (60 %), Acetic acid (5 %), Dioxane (5 %)
- ONHM: Oman Natural History Museum, Muscat
- SD: Standard Deviation
- SEM: Scanning Electron Microscope

Plate 1: Saudi Arabia:
Typical temporary
pond with stony desert
biotope at Mibhil (alti-
tude 800 m), habitat of
Branchipus schaefferi,
Triops numidicus and
Tanymastigites cyrenaica
(17.IV.1984). For an-
other view of the desert
environment at Mibhil
see BÜTTIKER (1985:
Plate 6).
Photo W. Büttiker.



Plate 2: Oman:
Sampling site in a wadi
pond at Shaqq (altitude
55 m), habitat of *Bran-
chinella spinosa*, *Eocyzi-
cus* sp. and *Eulimnadia*
aff. *margaretae* (March
1986).
Photo W. Büttiker.



Plate 3: Oman:
Sampling site in the
dunes near Mintirib
(altitude 269 m), habi-
tat of *Eulimnadia* aff.
margaretae (February
1986).
Photo W. Büttiker.



MATERIALS AND METHODS

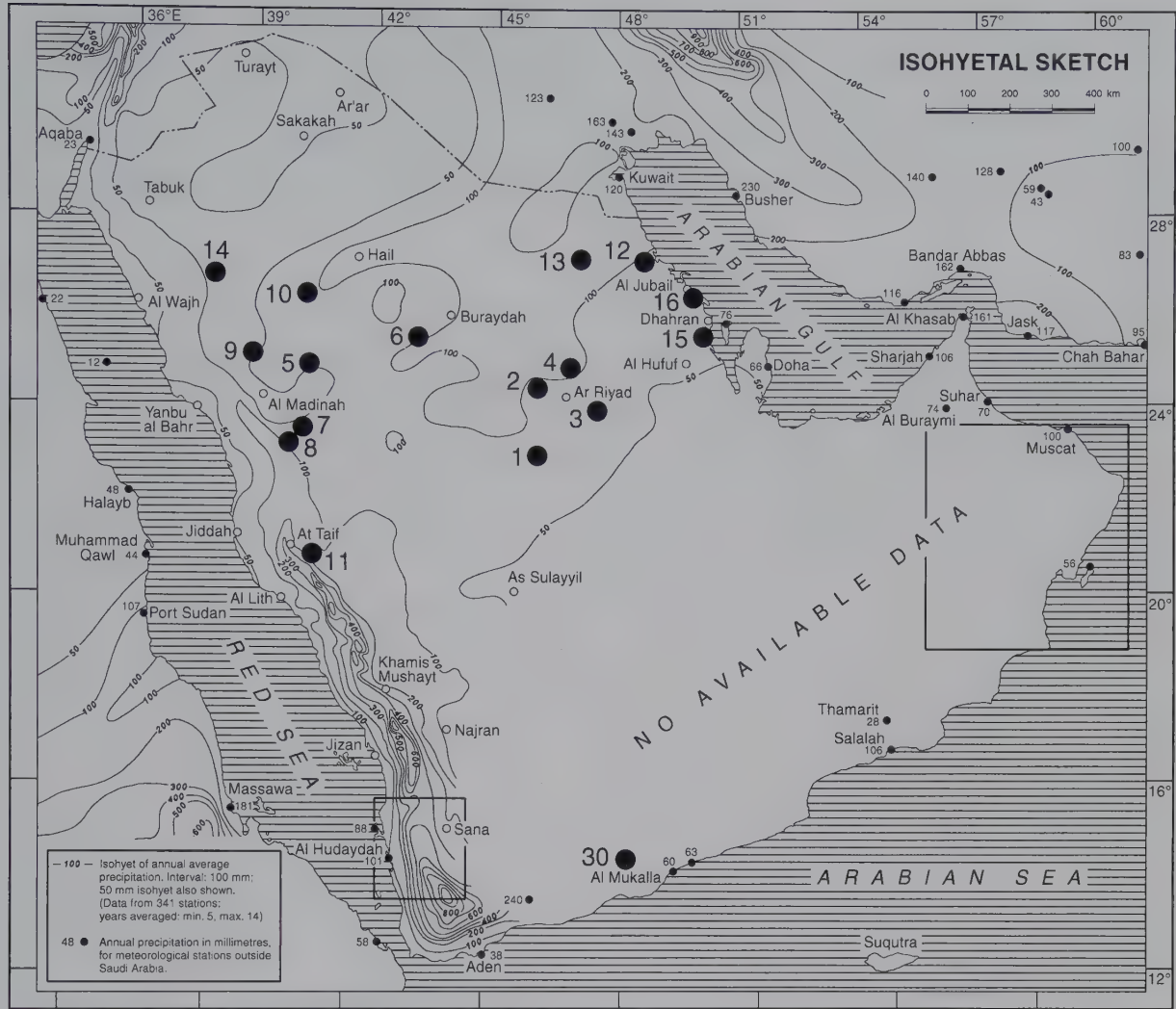
List of collecting sites (Figs 1-3 and Appendix)

The Arabian branchiopods were collected from temporary freshwater pools located mainly in western and central Saudi Arabia between Medinah and Riyadh and from the mountains in the south-east, while some saline waters were also sampled in the eastern region of the country (Dhahran). Samples from Oman were collected from many freshwater or brackish water rainpools in the east of the country (Wahiba Sands), the central and the northern regions (Fig. 2). The Yemen samples came from the mountains in the north. The Syrian "large branchiopods" were collected from temporary ponds near Deraa and Damascus in the west of the country.

The studied material was assembled by many different collectors: Prof. R. Kinzelbach (Institute of Zoology, Darmstadt, Germany) kindly brought the samples collected by Prof. W. Büttiker (Natural History Museum, Basel, Switzerland) collected from Saudi Arabia in 1976, 1984, 1985 and 1986, and in the zoological survey of Oman in 1986 ("Wahiba Sands Project"). These collections are complemented by some Arabian samples collected in 1959 to the south of Riyadh brought to my attention by Dr. M. Türkay (Forschungsinstitut Senckenberg, Frankfurt, Germany), by samples from Prof. H.J. Dumont (University of Gent, Belgium) collected in 1991 and 1992, by the Arabian samples of Dr. D. Belk, by samples from Yemen collected by Prof. H.J. Dumont and by Syrian samples collected by Prof. R. Kinzelbach in 1977 and by Dr. F. Krupp (Forschungsinstitut Senckenberg, Frankfurt, Germany) and Dr. W. Schneider (Hessisches Landesmuseum, Darmstadt, Germany) in 1980. Lastly many collections were made from Oman during the period 1982-1989 by M.D. Gallagher and colleagues (D. Chatty, M.R. Brown, K. Nievens). These were, in part, identified by Dr. G.A. Boxhall (BMNH, June 1982) and by Prof. H.J. Dumont (1989). Most of these specimens are now in the Collections of the Oman Natural History Museum in Muscat. The later samples from 1990-1995 were made in Oman by A.J. Spalton, R. Victor, E.R.L. Jones and M. Laurence. All these samples are registered under ONHM references.

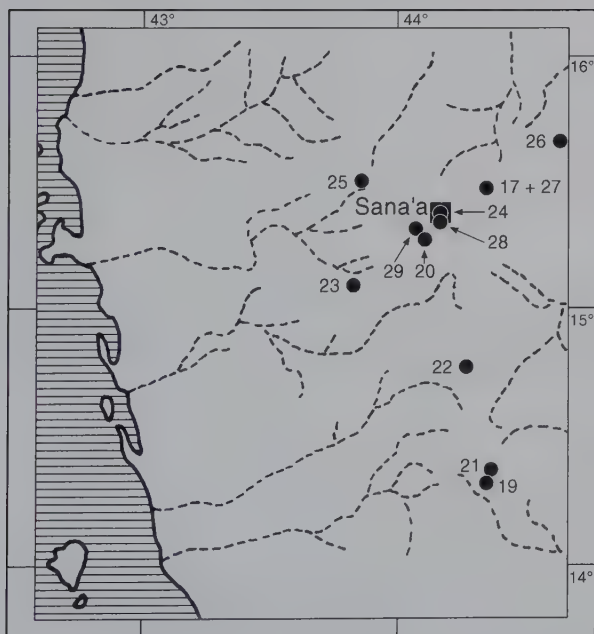
All the sites from which branchiopod material has been collected in Saudi Arabia, Oman, Yemen and Syria are listed chronologically in the Appendix of this paper with their geographical coordinates and altitude. Some data on substrate and aquatic vegetation are also given. The collecting sites have been plotted on two maps where the mean annual precipitation in Saudi Arabia (1967-1971; source: Ministry of Agriculture and Water, Riyadh) has also been drawn. The climatological data used in biogeographical interpretations is taken from SIRAJ (1984) for Saudi Arabia, GALLAGHER & WOODCOCK (1980) for Saudi Arabia and Oman, and COQUE-DELHUILLE & GENTELLE (1995) for Yemen. Some of the sampled sites are shown in Plates 1-3. For additional data see BÜTTIKER (1979, 1981, 1983, 1989). For an environmental description of the Wahiba Sands see BÜTTIKER & BÜTTIKER (1988) and BÜTTIKER & KRUPP (1989). The temporary pools in Yemen are not illustrated here but one of these biotopes is presented in SEGERS & DUMONT (1993: 9, Plate 4. A village pool near Kutab, south of Sana'a).

Figs 1-3: 1, Location of stations sampled on the Arabian Peninsula (black points) as they are referred to in Table 1, with mean annual precipitation in Saudi Arabia (1967-1971, Source: Ministry of Agriculture and Water, Riyadh 1972); 2, Map showing the sampling sites in Yemen as they are referred to in Table 1; 3, Map showing the sampling sites in Oman as they are referred to in Table 1.

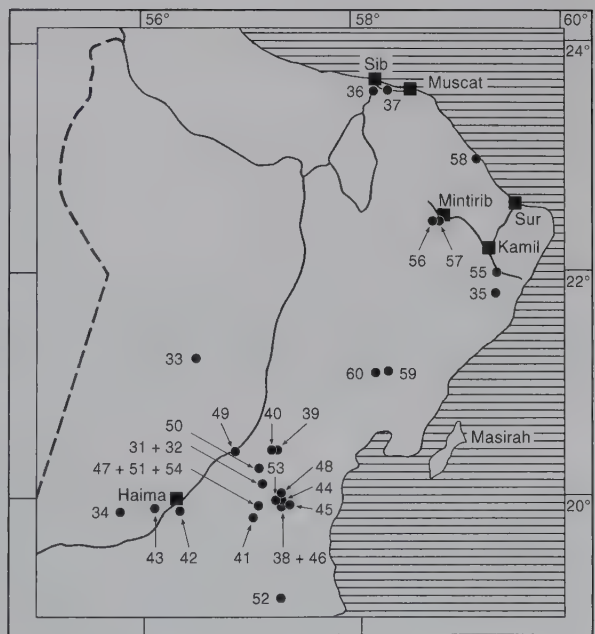


Source: From Gasperetti & Whitney in J.W. Whitney, 1983, USGS-TR-04-1, Plate 1 (modified)

1



2



3

Methods in SEM study

Stored specimens, fixed in the field in formalin or ethanol, were washed in distilled water, fixed in a bath of KAAD for 24 hours as recommended by THIÉRY & GASC (1991), dehydrated in an ethanol series and coated with gold after the critical point (CO₂ Bal-Tec CPD O30 Critical Point Dryer). Observations were made at an accelerating voltage of 20 KV using a Cambridge Stereoscan 360.

Identifications and measurements

Adults: The classification used follows FRYER (1987) in which the terms “phyllopod”, “euphyllopod” and “conchostraca” have no taxonomic value, the latter including the two orders Spinicaudata and Laevicaudata. In this paper I use the term “large branchiopod”, to be distinct from the Cladocera, the other group of the class Branchiopoda Latreille. (For a review of this class see THIÉRY 1996). This terminology is now classic and was used in the “International Large Branchiopod Symposium” convened in Ulm, in 1993. Anostraca were identified using DADAY (1910), BOND (1934), HARDING (1941), LINDER (1941), BRTEK (1972, 1974), ALONSO (1985) and THIÉRY (1987). For synonymies, the present paper follows the opinions of BELK & BRTEK (1995). Notostraca were identified with reference to LINDER (1952), LONGHURST (1955), BRTEK et al. (1984), THIÉRY (1987) and synonymies are in accordance with BRTEK & THIÉRY (1995). Spinicaudata were determined according to BOND (1934), GAUTHIER (1937), HARDING (1941), STRASKRABA (1965 a, 1965 b, 1966) and THIÉRY (1987). Measurements of specific dimensions were made using an ocular micrometer on a Wild stereoscope ($\times 7$), to the nearest 0.5 division (= 0.1 mm). For Anostraca, the length includes cercopods and furcal setae. For Notostraca, the length of the shield is taken from the front to the distal end of the carapace (see THIÉRY 1987) and the numbers of body rings do not include the telson. For Spinicaudata and Laevicaudata, the length and height are those of valves. Drawings were made with a Wild M7A Type 308700 stereoscope and a Wild M-20EB compound microscope, both equipped with a camera lucida.

Encysted gastrula: This stage is also called ‘cyst’ by several authors such as DE WALSCHE et al. (1991) and has previously improperly been referred to as ‘resting egg’ by others (Dumont, in litt.). The term ‘cyst’ is used in the present paper. Observations and measurements were made with the SEM on cysts removed from adult females with clutches presumed to be mature (the degree of maturity is not a discrete variable). The diameters of the cysts were measured under the SEM using the numerical line measure system (micrometer cursor) to the nearest 2–5 μm , following the magnification, and sometimes under stereoscope ($\times 40$) to the nearest 0.5 division (= 0.012 mm). Mean diameters are given with the standard deviation (\pm SD). The terminology used for the cyst wall structure follows DE WALSCHE et al. (1991).

Identifications and comparisons of shell morphology were made with reference to ALONSO & ALCARAZ (1984), MURA (1986), MURA & THIÉRY (1986), THIÉRY (1987), THIÉRY & GASC (1991), THIÉRY et al. (1995), and to the author’s collection (unpublished).

RESULTS

Regional names are used for ease of reference and do not have any political or administrative significance. The major ecological zones of Arabia used to discuss the distribution of species (Fig. 4) are adapted from LARSEN (1983) in SCHNEIDER & KRUPP (1993).

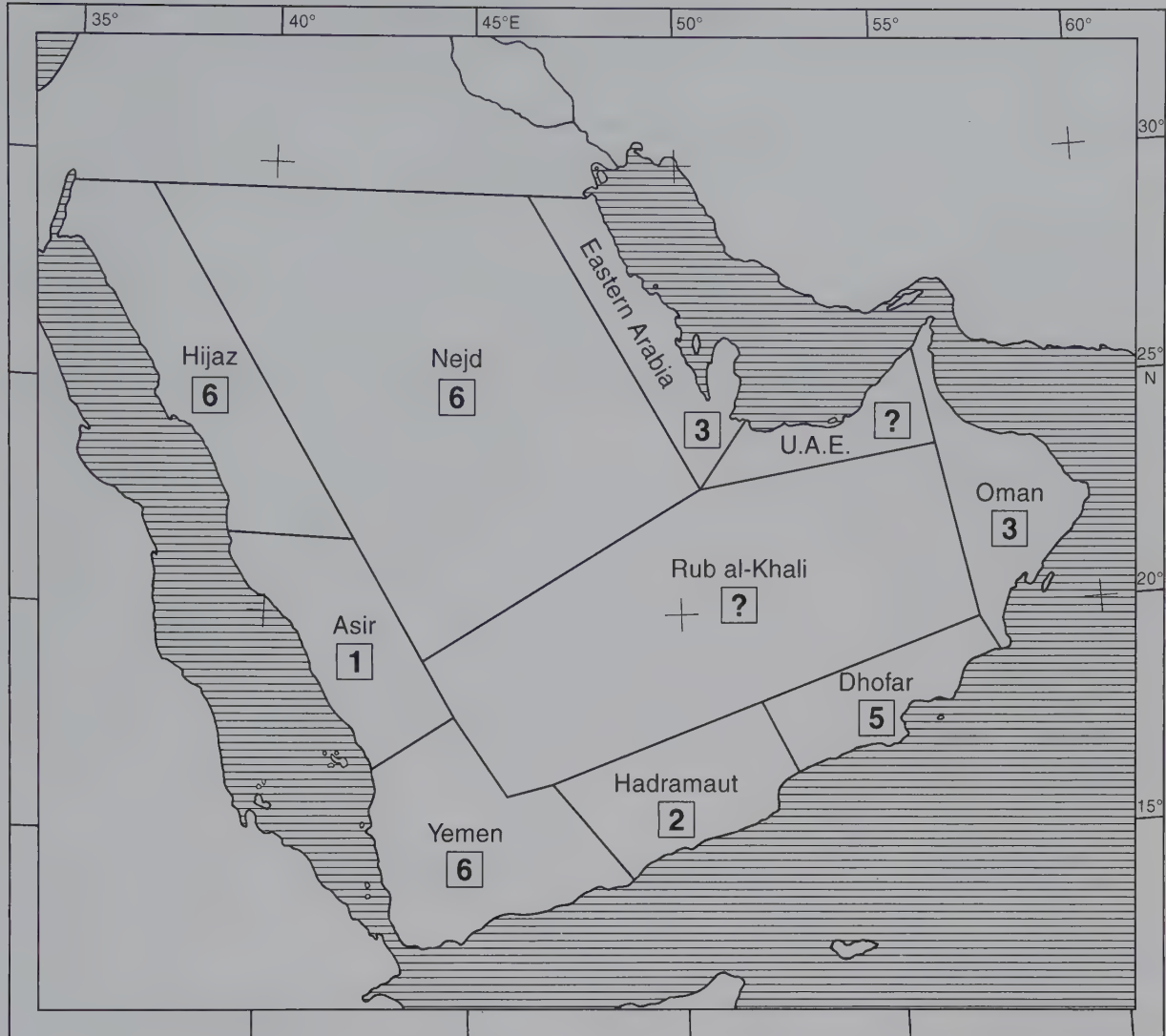


Fig. 4: Major ecological zones of Arabia; adapted from LARSEN (1983) and SCHNEIDER & KRUPP (1993). The number of "large branchiopod" species present in each of these zones is given in squares.

From all specimens collected, more than 1000 individuals, seven species were identified in Saudi Arabia: one Notostraca, four Anostraca and two Spinicaudata; seven species in Oman: three Anostraca, one Notostraca and three Spinicaudata; three species in Yemen: one Notostraca and two Anostraca, and three species in Syria: one Notostraca, one Anostraca and one Spinicaudata. All species are illustrated with microphotographs in SEM plates and, in part, with drawings. Their distribution is discussed in relation to the Africa-Asia hinge.

Some other species were described in the literature by BARROIS (1892) from Palestine, and by BOND (1934) and HARDING (1941) both from the south-western peninsula (in Yemen near Aden). Although they have not been collected recently, these species are included in the present list and are indicated with an asterisk.

In all, four species are listed from Syria and sixteen species from the Arabian Peninsula.

SYSTEMATIC ACCOUNT

Order Anostraca Sars, 1867

Family Artemiidae Grochowski, 1896

Artemia sp. (Fig. 5)

Material: Saudi Arabia: 4 ♀♀ (two ovigerous), 1.38-1.61 mm, 2 larvae, 0.88-1.20 mm, Dhahran, 8.III.1991, H.J. Dumont; 8 sub-adults (first cohort), 3.01-4.11 mm, 5 larvae (second cohort), 1.50-2.19 mm, Jubail, Sabkhat al-Fasl, 24.I.1992, H.J. Dumont.

Description: Male absent; female with a globular brood pouch, with two lateral expansions and two sublateral spines ventrally (Figs 5 a-b); cysts spherical, smooth and brown-orange in colour. Mean cyst diameter $218.7 \pm 8.57 \mu\text{m}$, range 208-234 μm , $n = 14$.

Distribution: The specimens from Dhahran and Sabkhat al-Fasl represent the first records of *Artemia* in Saudi Arabia. In the past several brine shrimps were collected in Syria in the salina of Djeroud, east of Damascus (BARROIS 1892), in Palmyra and Adana (DADAY 1910). Other specimens were also found in the northern part of the Arabian Peninsula in Iraq (GURNEY 1921, AL-UTHMAN 1971, KHALAF et al. 1977), and in the north-eastern region, in Kuwait (29°N, 47°E) (VANHAECKE et al. 1987). The present specimens are too young to discuss their mode of reproduction (parthenogenetic or sexual) and their specific identity. The cysts of the two mature females resemble the cysts of all other known populations in the Mediterranean basin (THIÉRY & GASC 1991) and India (MUNUSWAMY 1988).

Family Branchipodidae Daday, 1910

Branchipus schaefferi Fischer, 1834 (Figs 6, 10, 37)

Material: Saudi Arabia: 6 ♀♀, 14.2-17.2 mm, 150 km SSW of Riyadh, 13.VI.1959, E. Aichl; 1 ♂, 18.1 mm, used for SEM study, Hanakiyah, 21-25.I.1984, W. Büttiker; 1 ♂, 12.5 mm, 1 ♀, ovigerous, 13.5 mm, Mibhil, 17.IV.1984, W. Büttiker; 3 ♂♂, 10.2-11.0 mm, Wadi Tima, 26.IV.1985, W. Büttiker; 1 ♀, ovigerous, 10.7 mm, Wadi Rimah, W. Büttiker. — Oman: 29 ♂♂, 10.7-15.2 mm, 4 ♀♀ (three ovigerous), 11.2-15.0 mm, temporary pool in Yalooni, central Oman, 3.IV.1990.

Description: The antennae and frontal appendages of the male and the brood pouch of female are typical of the species. Cyst morphology as shown in Figs 6 d, 37 c; mean cyst diameter $276.4 \pm 11.7 \mu\text{m}$, range 260-289 μm , $n = 10$, are close to the cyst descriptions made from other areas, in England (GILCHRIST 1978), in Morocco (MURA & THIÉRY 1986), and in France (THIÉRY & GASC 1991). For a review of the compared distribution and cyst morphology of the representative of the genus in Europe see BRTEK & THIÉRY (1995) and THIÉRY et al. (1995).

Distribution: This genus, of the old-world Branchipodidae, is represented by five species including four endemic: *Branchipus blanchardi* in the French and Italian High Alps (ALONSO 1989, THIÉRY & GASC 1991), *B. cortesi* in western Spain (ALONSO 1991), *B. laeicornis* in Asia Minor (Eregli) (DADAY 1910) and *B. intermedius* in Rumania (ORGHIDAN 1947). *B. schaefferi*, the most widely distributed, is a common eurytopic species inhabiting temporary ponds in arid and semiarid regions (THIÉRY 1986 a). It is widespread especially in North Africa and in the Mediterranean basin (Spain, Morocco, Algeria, Tunisia, Southern France, Italy), and extends to Sudan (RZÓSKA 1961, 1984) and Asia (KEMP 1911). *B. schaefferi* is common in Palestine (DIMENTMAN 1981, POR 1989, Thiéry unpublished) and has been found recently in Jordan by MURA & COTTARELLI (1985).

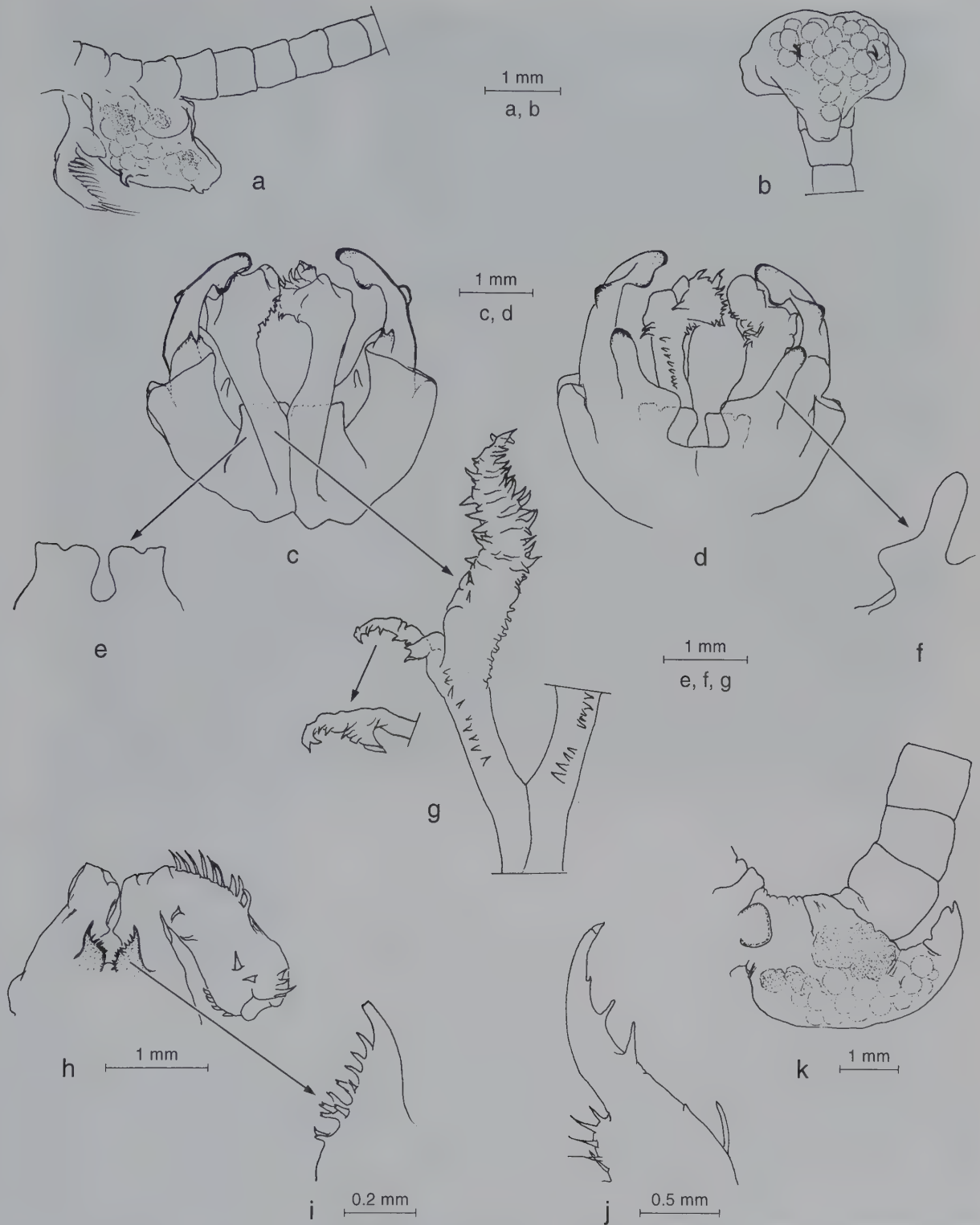


Fig. 5: a-b, *Artemia* sp., ♀ from Dhahran, Saudi Arabia: a, brood pouch in left lateral view; b, same in ventral view. c-k, *Tanymastigites cyrenaica* from Mibhil, Saudi Arabia: c, dorsal view of ♂ antennae; d, ventral view of ♂ antennae; e, detail of the clypeal laminae situated under the antennal outgrowth; f, detail of the antennal lamella; g, dorsal view of the antennal serrated laminar outgrowth with a detail of its forked external branch; h, ventral view of the penes, one of them being devaginated; i, detail of the external ornamentation situated at the base of the penes; j, endopodite of the third leg of the ♂; k, brood pouch of the ♀ in left lateral view.

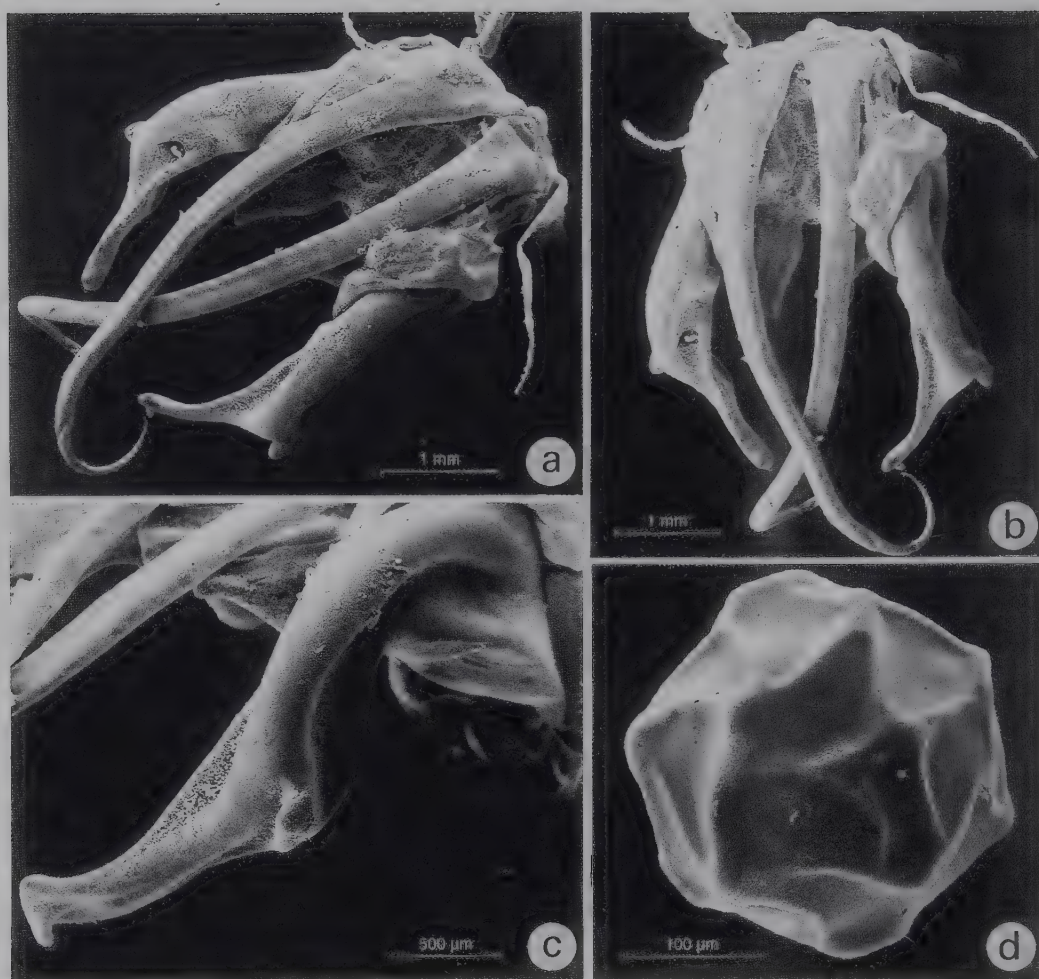


Fig. 6: *Branchipus schaefferi* from Hanakiyah, Saudi Arabia: a, general view of ♂ head; b, same, frontal view; c, detail of second antenna; d, cyst.

***Branchipodopsis* n. sp. Thiéry, in press (Figs 7-8, 37)**

Material: Oman: 1 ♂, 10.5 mm, 1 ♀, 11.3 mm, without cysts, Bukaratub, 20.IV.1982, M.D. Gallagher; 1 ♂, used for SEM study, 3 ♀♀ (cysts in formation), 11.0-14.0 mm, Bulkharait, Huqf, 27.III.1990, A. Spalton; 11 ♂♂, 9.3-13.0 mm, Haylat Daly, Huqf, 27.III.1990, A. Spalton; 2 ♀♀, young, 7.2-7.3 mm, one with 11 cysts, the other without cysts, Jiddat al-Harasis, 11.III.1995, M. Laurence; 15 ♂♂, 9.2-11.2 mm, 7 ♀♀ (one ovigerous), 9.8-11.2 mm, 25 cysts free in water, mean cyst diameter $253.54 \pm 8.46 \mu\text{m}$, range 237.5-275 μm , Haylat Yalooni, 25.III.1995, M. Laurence.

Description: see THIÉRY (in press). Male: frontal appendage absent; the second antenna is long, slender and has a twisted terminal segment with a cupular depression on the outside of the spoon-shaped distal part (Fig. 7 a); two anvil-shaped knobs on the front, between the two antennae, bearing one spiny outgrowth on their external border (Figs 7 a-b, 8); base of each antenna II with a lamella (Fig. 7 b); genital segments (= two first abdominal segments) slightly swollen ventrally, penes arising ventrally near each other, their non-retracting part reaching the half of the third abdominal segment; telson with two ventral spines (Fig. 8 c); cercopods long, curved inward, setiferous on the greater part of the outer margin; the inner margin is setiferous in two thirds while it is provided with spines on the last third (Fig. 8 c). Female: antenna II more or less flat, with a spiny tip (Fig. 8 d); brood pouch short and more or less swollen tubularly, not reaching half of the third abdominal segment (Fig. 8 e-f); telson without ventral spines, cercopods straight

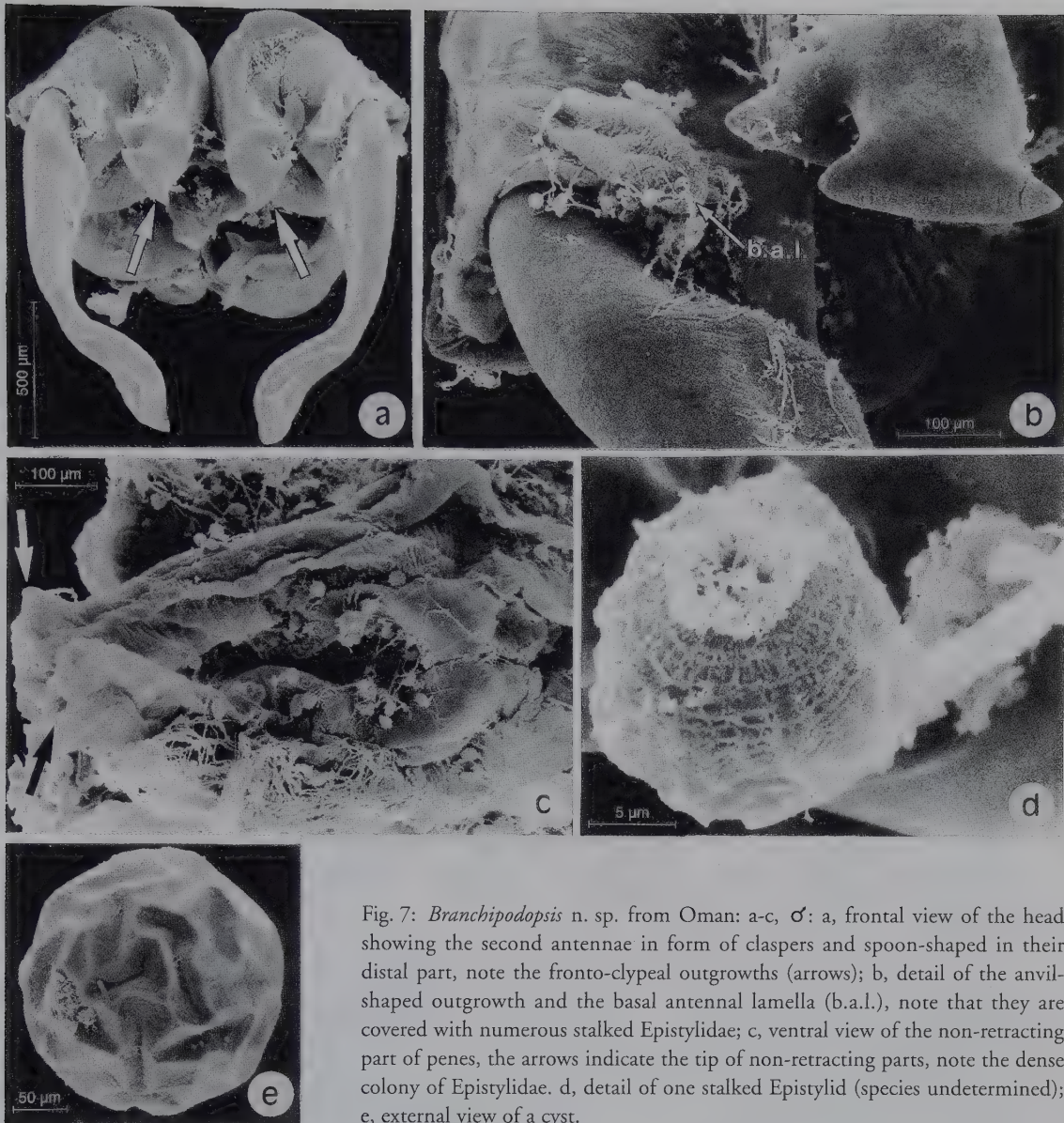


Fig. 7: *Branchipodopsis* n. sp. from Oman: a-c, ♂: a, frontal view of the head showing the second antennae in form of claspers and spoon-shaped in their distal part, note the fronto-clypeal outgrowths (arrows); b, detail of the anvil-shaped outgrowth and the basal antennal lamella (b.a.l.), note that they are covered with numerous stalked Epistylidae; c, ventral view of the non-retracting part of penes, the arrows indicate the tip of non-retracting parts, note the dense colony of Epistylidae. d, detail of one stalked Epistylid (species undetermined); e, external view of a cyst.

and uniformly setiform; cysts red brown, spherical, with a crumpled appearance (Figs 7 e, 37 l), mean cyst diameter (measured under SEM) $248.66 \pm 2.25 \mu\text{m}$, $n = 6$, mean diameter measured under stereoscope, $253.54 \pm 8.46 \mu\text{m}$ ($n = 25$). The females studied from Yalooni Haylat (ONHM 2456) bear on their antennae II several green algae (Chlorococcales, see Fig. 8 d), the male from Bulkharait was covered, on head and penes, by dense colonies of Epistylidae (stalked Protozoans, species not identified; Figs 7 a-d). The presence of epizootics is more or less common in temporary pools (THIÉRY & CAZAUBON 1992). A high density of Epistylidae indicates that the water was turbid and rich in organic matter (Thiéry & Cazaubon in prep.).

Distribution: To date, this species may be considered as endemic to Oman. It inhabits temporary spring rainpools in the central Sultanate (Dhofar), over a restricted area ranging from $20^{\circ}11' - 19^{\circ}56' \text{N}$ and $57^{\circ}06' - 57^{\circ}21' \text{E}$ at an altitude of 140-154 m. No data on the climate are available but this area can be considered as arid (annual rainfalls probably $< 100 \text{ mm}$). This record

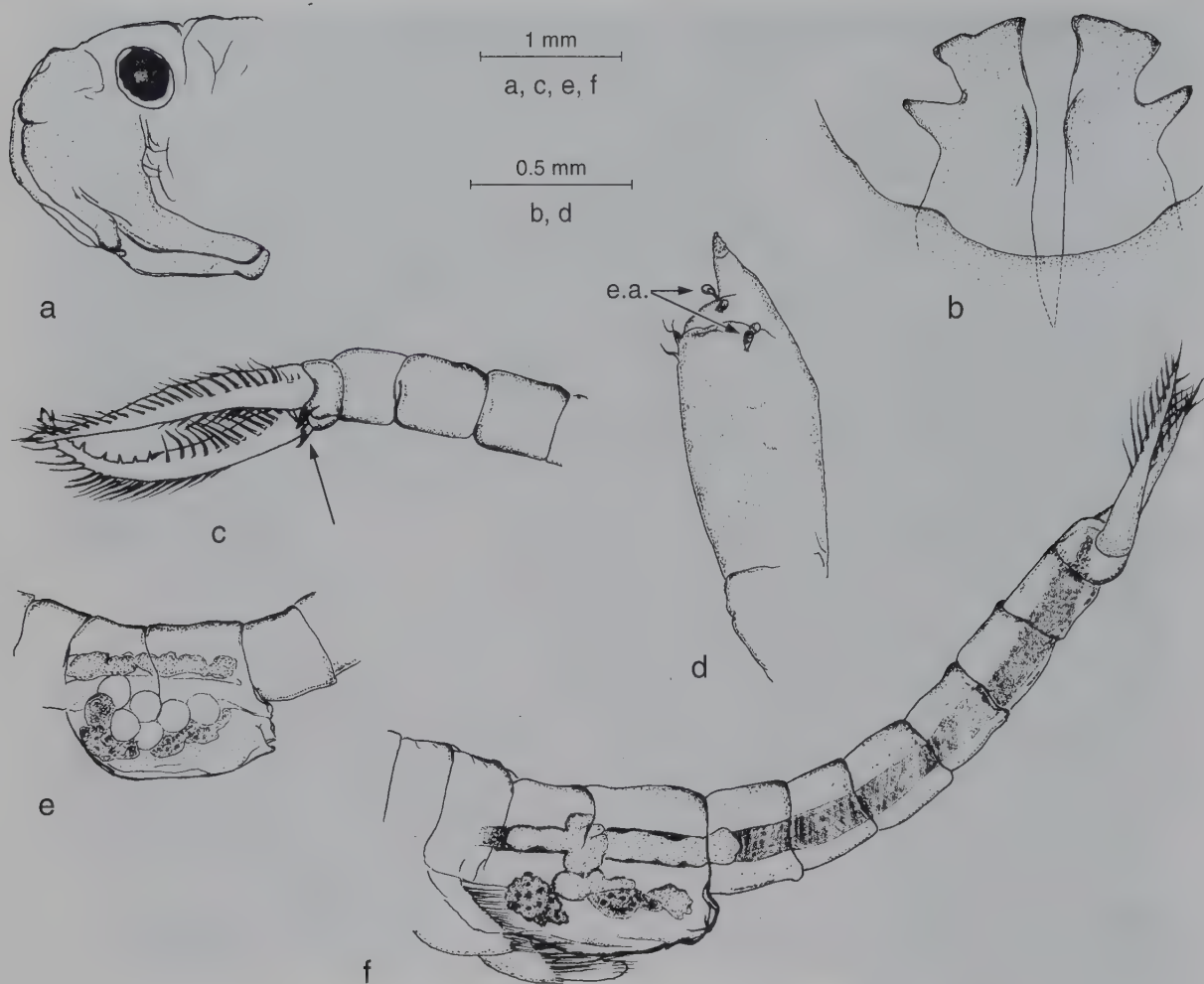


Fig. 8: *Branchipodopsis* n. sp. from Oman: a-c, ♂: a, head in left lateral view; b, detail of the fronto-clypeal outgrowths; c, end of abdomen in right ventro-lateral view, note the two ventral spines on telson (arrow). d-f, ♀: d, second antenna with epizootic algae (e.a.), *Chlorococcales*; e, left lateral view of abdomen; f, left lateral view of abdomen showing the brood pouch and telson.

of the species represents the first one for the genus *Branchipodopsis* in Arabia. It makes the link between the two disjunct African and Asiatic areas where 16 known *Branchipodopsis* species are distributed. (13 species for the African group, see BRAUER 1877; SARS 1898, 1901; DADAY 1910; BARNARD 1924-1926, 1929; SMIRNOV 1936; LINDER 1941; LÖFFLER 1968; HAMER 1989; 3 species for the Asiatic group, see SMIRNOV 1932, BOND 1934, UÉNO 1940, HARTLAND-ROWE 1968 a, MALHOTRA & DUDA 1970, TIWARI 1972, BRTEK et al. 1984, VEKHOV 1992).

Tanymastigites cyrenaica Brtek, 1972 (Figs 5, 9, 37)

Material: Saudi Arabia: 1 ♀, ovigerous, 18.0 mm, 7 ♂♂, 17.0-20.8 mm, Mibhil, 17.IV.1984, W. Büttiker.

Description: see BRTEK (1972). Male with strong and curved antennae, bilobed at their distal ends (Figs 5 c-d); serrated laminar outgrowth present on antenna with an external branch in the middle part (Fig. 5 g); devaginated part of the penes with a row of numerous strong spines, up to ten (Fig. 5 h). Female with a fusiform brood pouch, reaching the second post-genital segment (Fig. 5 k); cysts spherical, mean diameter $388.5 \pm 6.11 \mu\text{m}$, range 379-397 μm , $n = 11$. Their alveolar shell is covered by numerous hairs (Figs 9 b, d, f) as in the cysts of *Tanymastigites brteki*

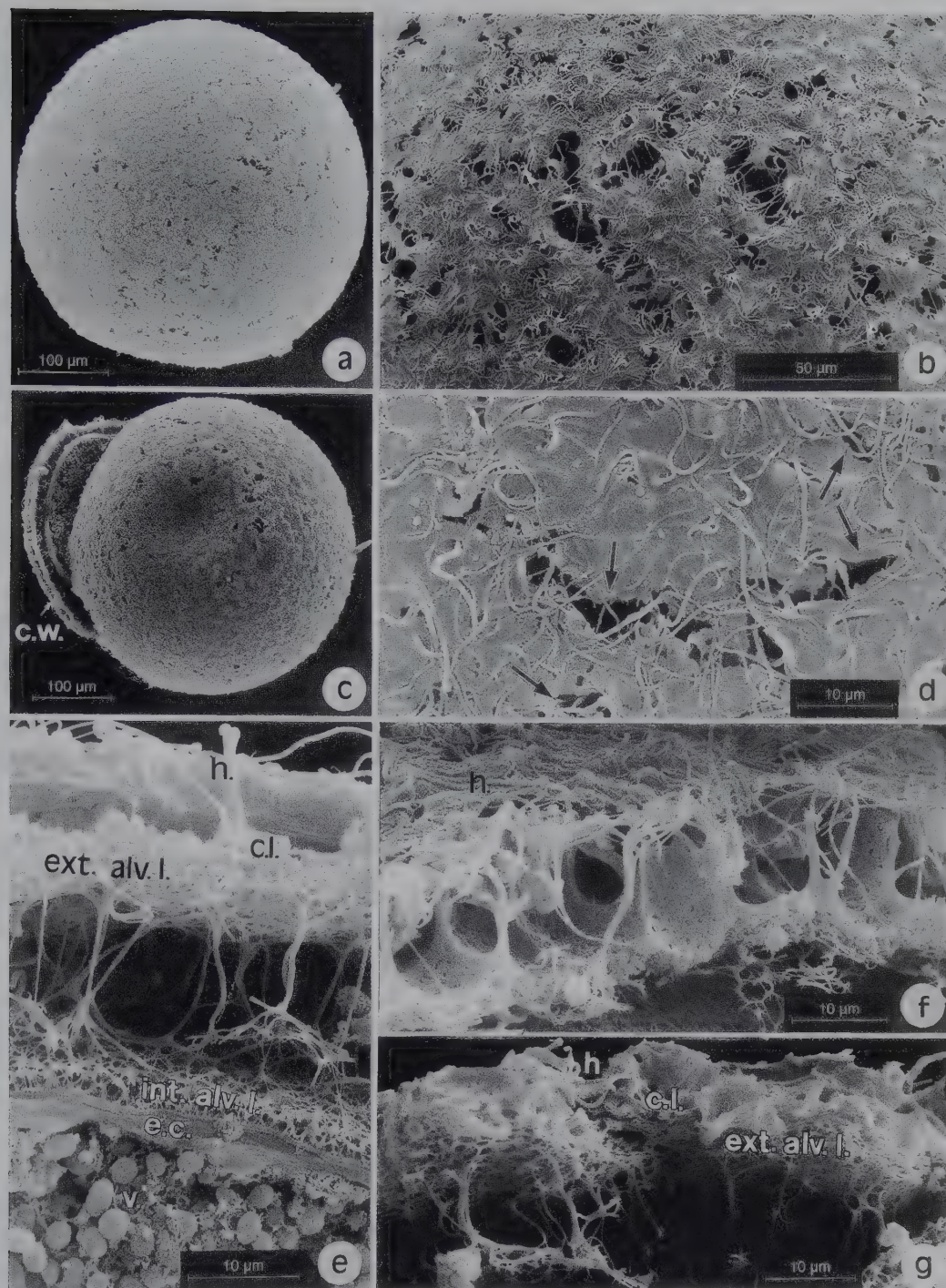


Fig. 9: *Tanymastigites cyrenaica* from Mibhil, Saudi Arabia: a, cyst; b, detail of cyst surface; c, cracked cyst showing a section of the cyst wall (c.w.); d, detail of the cyst surface, with externally visible 'hairs' rising up off the cortical layer (here more or less crazed, see arrows); e, cross-section of the cyst wall showing the vitellus (v.), the embryonic cuticle (e.c.), the multilayered alveolar layer with the internal layer (int. alv. l.) and the external layer (ext. alv. l.), the cortical layer (c.l.) and the external hairs (h.); f, same in different view, external alveolar layer, cortical layer and hairs only; g, same in different view.

(MURA & THIÉRY 1986). The structure of the cyst wall (Figs 9 e-g) is close to that of *Tanymastigites cyrenaica* of Libya (Thiéry, unpublished data).

Distribution: Before its discovery in Saudi Arabia the genus was considered endemic to North Africa, north of the 30th parallel (THIÉRY 1986 b, BANARESCU 1992). The species known to date include two in Morocco, *Tanymastigites jbiletica* Thiéry & Brtek, 1985 and *T. brteki* Thiéry, 1986, two in Algeria, *T. mzabica* (Gauthier, 1928) and *T. perrieri* (Daday, 1910) and two in Libya, *T. cyrenaica* Brtek, 1972 and a new species (Thiéry & Dia, in prep.). After careful examination of Daday's syntypes of *Tanymastigites perrieri* (= *Tanymastix perrieri*), Belk (in litt.) concluded that the species *Tanymastigites jbiletica* appears to be a synonym of the former, so the number of known species amounts to five. The extension of *T. cyrenaica* into Saudi Arabia is of special interest, raising the question of biotic interchanges between North Africa and Arabia. The genus *Tanymastigites* co-occurs with *Branchipus schaefferi* (GAUTHIER 1928 b) and most of the time with *Triops numidicus*

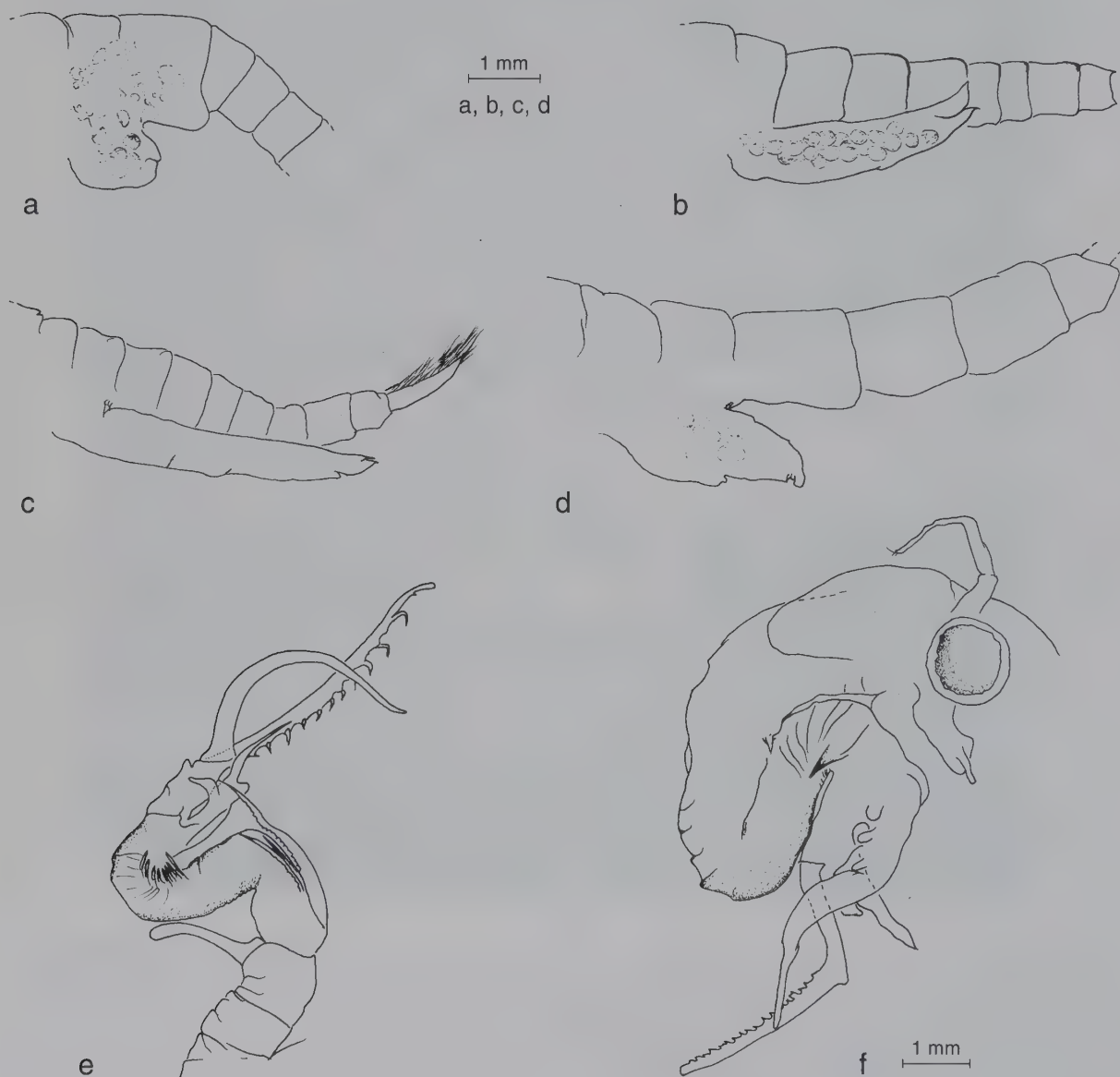


Fig. 10: a-d, comparison of ♀ brood pouch in different species: a, *Branchipus schaefferi*; b-c, *Streptocephalus* sp.; d, *Branchinella spinosa*. e, second antenna, left, of *Streptocephalus simplex*, redrawn from BOND (1934), no scale given; f, head of a Saudi Arabian *Streptocephalus* sp. ♂, second antenna, right, in inner lateral view.

and *Leptestheria mayeti*, as in Morocco from where this association was described by THIÉRY (1987). These co-occurring species are typical of the arid and Saharan (= per arid) zones (sensu THIÉRY 1987), also called steppic zone by GAUTHIER (1928 a). The respective lengths of *Tanymastigites cyrenaica* (17.0-20.8 mm), *Branchipus schaefferi* (12.5-13.5 mm) and *Triops numidicus* (9.4-10.7 mm) agree with the growth curves of the Moroccan populations given by THIÉRY (1991). *Tanymastigites* grows more rapidly than *Branchipus schaefferi* and *Triops numidicus* but dies earlier. This particular life cycle might explain the fact that the genus *Tanymastigites* has been rarely collected during Arabian missions. A frequent survey (every week) of temporary ponds from the first day of flooding is required to find these ephemeral species.

Family Thamnocephalidae Packard, 1877

Branchinella spinosa (Milne-Edwards, 1840) (Figs 10-11, 37)

Material: Oman: 27 ♂♂, 16 ♀♀ (few ovigerous) in bad state of preservation, no measurements, Wadi al-Batah, 22.II.1986; 6 ♂♂, 16.0-20.0 mm, and 4 ♀♀, ovigerous, 17.5-24.1 mm, mean cyst diameter $223.6 \pm 8.4 \mu\text{m}$, range 225-235 μm , n = 25, Shaqq, 6-10.III.1986, W. Büttiker.

Description: The scanning micrographs (Fig. 11) complete the drawings of ALONSO (1985) and VEKHOV (1990). Cysts are spherical with a system of ridges which defines a series of, mostly, deep pentagonal depressed fields (Figs 11 g-h, 37 h). The range in the diameters of the cysts is close to the measurements made from cysts of Spanish, Moroccan and French populations (ALONSO & ALCARAZ 1984, MURA & THIÉRY 1986, THIÉRY & GASC 1991).

Distribution: This euryhaline species, firstly described from salt waters near Odessa, is reported principally from inland and coastal salt waters of the Mediterranean basin: Spain (ALONSO 1985), Morocco (THIÉRY 1986 a), Algeria (GAUTHIER 1928 a), France (THIÉRY & GASC 1991), Sardinia and Italy (TAGLIASACCHI-MASALA 1969, MURA 1986), and Cyprus (MURA & HADJISTEPHANOU 1987) with a scarce distribution in shotts, sabkhas and saltworks. *Branchinella spinosa* has also been reported from Turkey (COTTARELLI & MURA 1974), and Afghanistan (BRTEK 1974). The present records thus provide a logical range extension for this species. In Spain, its salinity range as determined by ALONSO (1990), is 25-60 ‰. No chemical data are available for samples from Oman.

Family Chirocephalidae Daday, 1910

Chirocephalus neumanni Hartland-Rowe, 1967

Material: Syria: 3 cysts, diameter 350 μm , Damascus-Qunaitra Road, 20.III.1980, F. Krupp & W. Schneider.

Description: The cysts are covered with thin ridges crossing to form a number of regularly shaped polygonal cells, also named a honeycombed surface, and so could be attributed to the *Chirocephalus* 'diaphanus group' (see BRTEK & THIÉRY 1995). Their diameter is close to that of the cysts of *Chirocephalus neumanni* of Palestine (304-350 μm , Thiéry, original data), while the cysts of the other widespread chirocephalid in Palestine, *Chirocephalus bairdi*, are smaller (271-306 μm , see THIÉRY et al. 1995: Figs 10 a-c). Moreover, if we consider the respective distribution of these two chirocephalids in Palestine (DIMENTMAN 1981, Thiéry, original data), *Chirocephalus neumanni* is the most common species in the north-east of the country, in the Galilee heights. Considering the nearness and the homogenous environment (climatic and geological) between the Syrian pool and Galilee, *C. neumanni* could be expected to occur in the west of Syria.

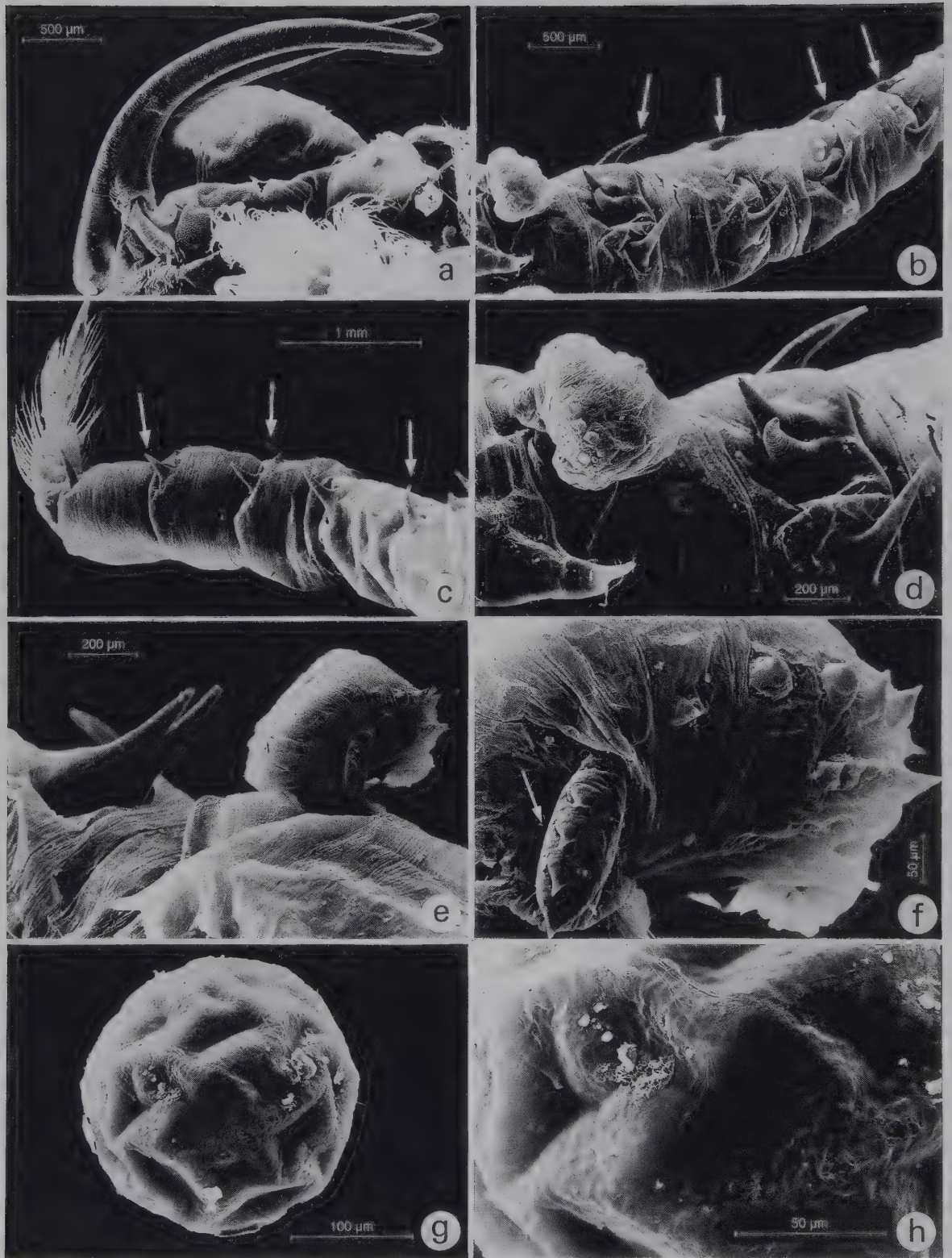


Fig. 11: *Branchinella spinosa* from Shaqq, Oman: a, second antenna of ♂ in lateral view; b, left lateral view of abdomen, anterior part, with one penis erected, note the lateral spines (arrows); c, right lateral view of abdomen, terminal part, with lateral spines (arrows); d, detail of one erected penis, the second is invaginated; e, same in left lateral view; f, detail of row of spines on penes (arrow); g, cyst; h, detail of egg surface.

Family Streptocephalidae Daday, 1910

Streptocephalus torvicornis (Waga, 1842) (Figs 12-13, 37)

Material: Yemen: 11 ♂♂, 23.5-33.0 mm, 7 ♀♀ (one ovigerous), 24.3-33.8 mm, Kutab, 80 km S of Sana'a, 24.VI.1990, H.J. Dumont; SEM photographs of one cyst from Rabat al-Sha'ry, Yemen, in DE WALSCHÉ et al. (1991).

Description: The male antennae of the specimens from Yemen closely resemble those of the Moroccan *Streptocephalus torvicornis*, but with a greater variability in the spination of the thumb (Figs 12 e-i). Cysts (Figs 13 f-h, 37 i) with a mean diameter of $234.8 \pm 2.7 \mu\text{m}$, range 231-239 μm , $n = 8$. Morphologically, the cysts are closely related to those of Maghrebian *Streptocephalus torvicornis* recorded by THIÉRY (1987) with ridges giving the surface a folded look. They also agree with the cyst morphology described by DE WALSCHÉ et al. (1991) on a *Streptocephalus torvicornis* recorded from another location in Yemen, in Rabat al-Sha'ry. However, the cysts of specimens from Kutab have a slightly smaller diameter than the Moroccan cysts (260-275 μm). There are no data available on cyst diameter from Rabat al-Sha'ry. In view of the variability in spination of the thumb and the smaller diameter of the cysts, this species has probably evolved from a North African ancestor. For a review of the systematics of the Streptocephalidae see MAEDA-MARTINEZ et al. (1995). Its location, concentrated in the Yemeni mountains, might favour an endemic evolution.

Distribution: Species concentrated in the mountains of Yemen.

Streptocephalus sp. (Figs 10, 12-14, 37)

Material: Saudi Arabia: 4 ♀♀ (one ovigerous), 11.9-14.1 mm, 150 km SSW of Riyadh, 15.VI.1959, E. Aichl; 4 ♂♂, 11.1-12.0 mm, Wadi Tima, 26.IV.1985, W. Büttiker; 13 ♂♂, 20.1-21.0 mm, Qaba, 5.V.1985, W. Büttiker; 70 ♂♂, 11.4-13.9 mm, 11 ♀♀ (eight ovigerous), 11.8-13.3 mm, Wadi Rimah, 5.V.1985, W. Büttiker; 11 ♂♂ (specimens dried), Makkah, al-Uqdah, 28.V.1985, W. Büttiker; 6 ♂♂, 9.6-14.1 mm, 16 ♀♀ (eight ovigerous), 9.1-15.5 mm, same locality and collector, 30-31.V.1985.

Description: As regards the structure of the second antenna of the male (Figs 10 f, 12 a-c, 14 a, c) and particularly the morphology of the thumb, the Saudi Arabian specimens resemble *Streptocephalus torvicornis* occurring in North Africa (ROUX & THIÉRY 1988; DUMONT et al. 1991, 1995) and in the coastal plain and foothills of Palestine (HARTLAND-ROWE 1967, DIMENTMAN 1981). In particular, the denticulation may be included in the variation pattern existing between populations in northern African *S. torvicornis* (DUMONT et al. 1991). The ratio of the lengths of thumb to spur (a/b), a criterion defined by THIÉRY (1987) and ROUX & THIÉRY (1988) and criticised by DUMONT et al. (1991), is equal to 2.5 (range 2.46-2.71), so it is close to the ratio in Moroccan *Streptocephalus torvicornis bucheti*. However, the thumb is more curved than in the North African *S. torvicornis*. In the female the brood pouch extremity reaches the last abdominal segment (Figs 10 b-c, 12 d). The cyst morphology (Figs 13 b, d-e, 37 b) differs from the *S. torvicornis* pattern (Fig. 13 a, and see ALONSO & ALCARAZ 1984, MURA & THIÉRY 1986) but is closely related to the *S. rubricaudatus* cyst pattern, which is plaited bowl-shaped (Fig. 13 c). The cyst diameter, $252.7 \pm 11.8 \mu\text{m}$, is slightly smaller than in *S. rubricaudatus* ($280.0 \pm 0.4 \mu\text{m}$) and the domed straps have a longitudinal slit which is absent in *S. rubricaudatus*. From a biogeographical point of view, the African *S. torvicornis* occurs throughout the Sahara (Adrar of Mauritania, Hoggar, Aïr and Tibesti) but seems to be lacking in eastern Libya, Egypt and Sudan where *S. rubricaudatus* occurs (KLUNZINGER 1867, HARTLAND-ROWE 1968 b, BRTEK 1974; MERTENS & DUMONT 1989, DUMONT et al. 1991). Is *Streptocephalus* sp. a sublineage coming from a North African ancestral streptocephalid (in which case the three streptocephalids *S. torvicornis*, *S. rubricaudatus* and *Streptocephalus* sp. might be considered as vicariant species) or is it a case of natural hybridisation between *S. torvicornis* and *S. rubricaudatus* (male antennae of *S. torvicornis*

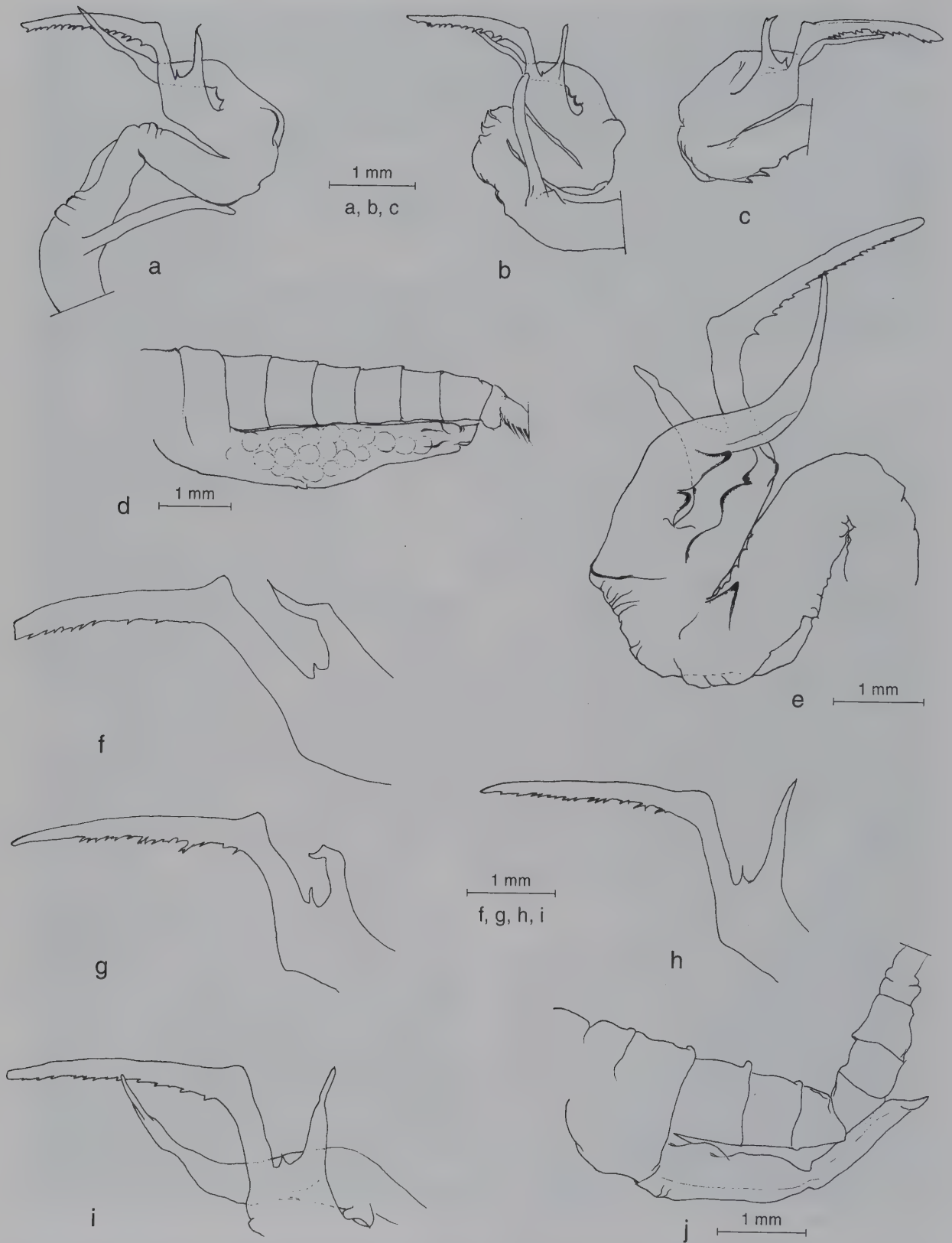


Fig. 12: a-d, *Streptocephalus* sp. from Wadi Rimah, Saudi Arabia: a-c, second antenna of ♂, with variation in denticulation of thumb and in shape of spur; d, ♀, left lateral view of ovisac. e-j, *Streptocephalus torvicornis* from Kutab, Yemen: e, second antenna of ♂; f-i, variation in denticulation of thumb and in shape of spur on second antenna of ♂; j, ♀, left lateral view of ovisac.

and cyst of *S. rubricaudatus*)? The latter hypothesis seems doubtful because the two species were found to be sympatrical both in space and time in four temporary pools in the Tassili n'Ajjer plateau (Algeria) and no case of hybridism was found (MERTENS & DUMONT 1989). We could note however, that several cases of natural hybridisation have been described in the genus *Streptocephalus* in North America by WIMAN (1979). With the lack of a more detailed study, this *Streptocephalus* species remains unnamed.

Distribution: Common in temporary waters to the south of Riyadh and in the western mountain ridges from Medinah to the Asir. *Streptocephalus* occurs in regions where annual rainfall ranges from 100 mm to more than 400 mm (Asir). The same type of distribution, in rainy regions of arid countries, was observed for *Streptocephalus torvicornis bucheti* in Morocco (THIÉRY 1986 a,

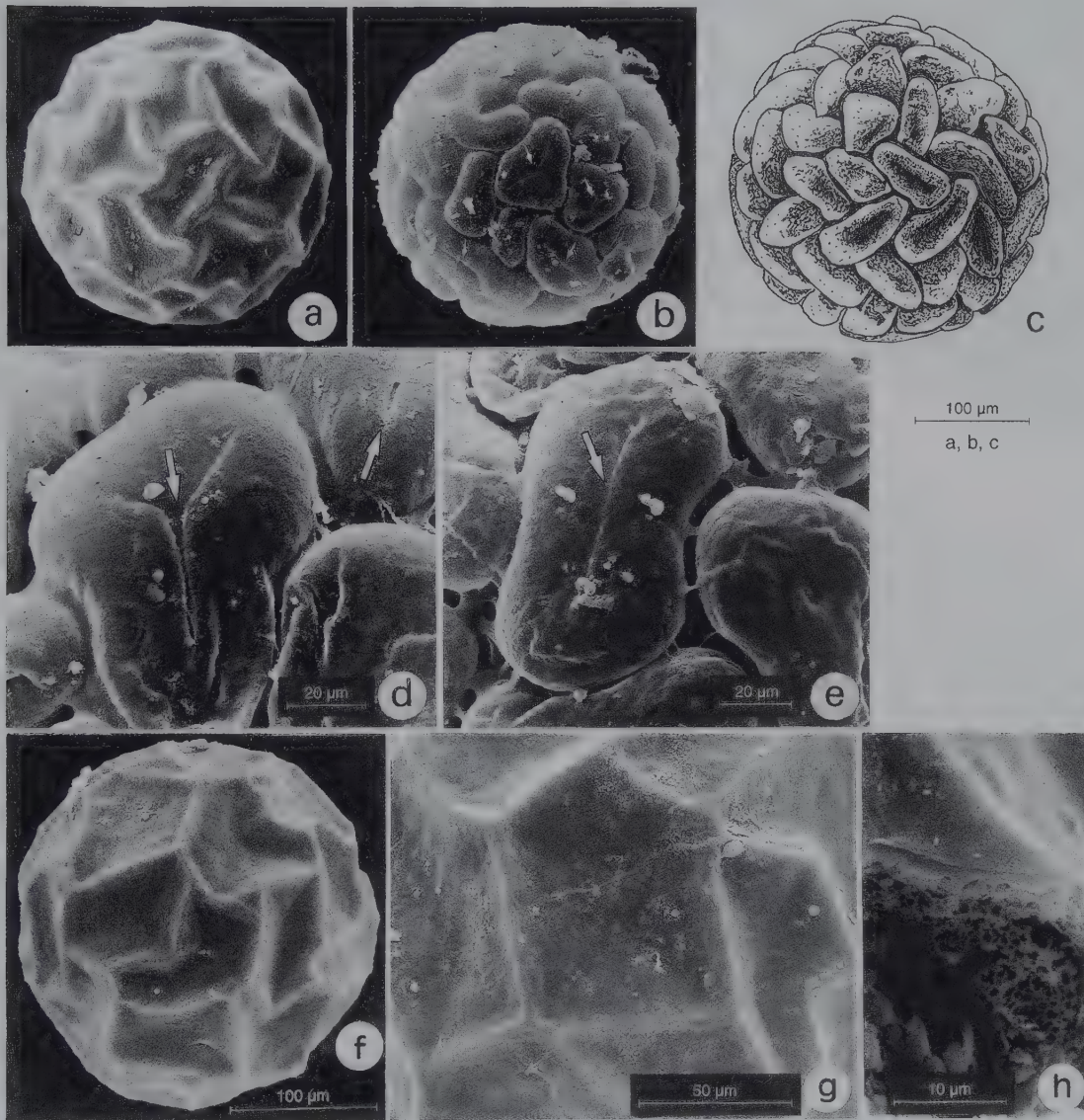


Fig. 13: Cysts of *Streptocephalus* species: a, European *S. torvicornis* from Slovakia; b, *Streptocephalus* sp. from Saudi Arabia; c, *S. rubricaudatus*, drawn from an original SEM micrograph, loan from H. Saïah (pers. comm.); d-e, details of surface ornamentation with slits on the domed straps (arrows) in *Streptocephalus* sp. from Saudi Arabia; f, *S. torvicornis* from Kutab, Yemen; g, same, enlarged section; h, cross-section of the wall.

1987), for *Streptocephalus torvicornis torvicornis* in Algeria and Tunisia (GAUTHIER 1928 a) and for *Streptocephalus torvicornis* in Palestine (DIMENTMAN 1981).

Remarks: Specimens of *Streptocephalus* collected by Peters at station 12 and by Krupp & Schneider at station 14 (see Appendix) have been identified as *S. torvicornis*. I have not seen these specimens, but judging from their geographical origin they might belong to this *Streptocephalus* species.

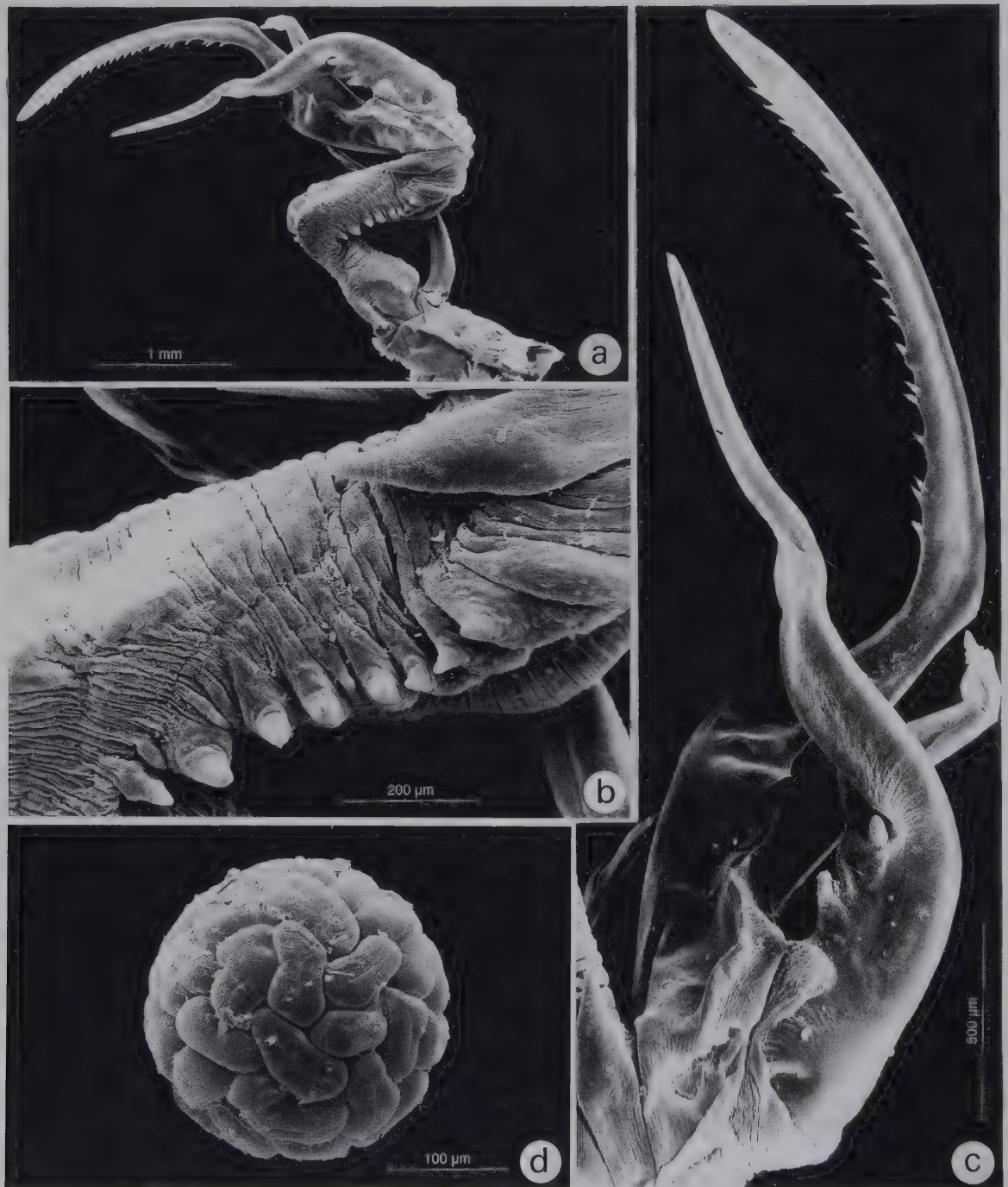


Fig. 14: *Streptocephalus* sp. from south of Riyadh, Saudi Arabia: a, inner view of second antenna of ♂; b, detail of tubercles of the basal part; c, detail of pincer of second antenna, inner view; d, cyst.

* *Streptocephalus neumanni* Thiele, 1904

Description: A streptocephalid species described by THIELE (1904) from Ethiopia. This species differs from the other Arabian streptocephalids by the presence of a long frontal appendage with two lateral branches in male specimens. It belongs to the '*torvicornis* group - *proboscideus* subgroup' sensu MAEDA-MARTINEZ et al. (1995). The cyst is unknown.

Distribution: The species was first found in an African locality, in Ennia Galla-district, Ethiopia, and was cited in Yemen from three temporary ponds on the Jebel Jihaf in Aden by HARDING (1941). Some other specimens are listed from Yemen in the BMNH: 6 ♂♂, 11 ♀♀, Jebel Jihaf (= Jebel Jinah in MAEDA-MARTINEZ et al. 1995), 7800 feet, BMNH 1939.10.25: 1-20; 1 ♂, 5 ♀♀, Rassais (= Rossais), Wadi Habib (= Adi? Hatib), BMNH 1962.5.21: 1; 12 ♂♂, 10 ♀♀, Jolebeid near Wadi Dam (= Duan), BMNH 1954.7.8: 1, and Sirah Batawil, Fisarab, Hadramaut.

Remarks: Not yet found in Saudi Arabia or in Oman. For the measurements of the material from Yemen kept in the BMNH see MAEDA-MARTINEZ et al. (1995).

* *Streptocephalus simplex* Gurney, 1906 (Fig. 10 e)

Streptocephalus simplex arabicus Bond, 1934: 29-62.

Description: The fairy shrimps collected near Aden have been described as *S. simplex arabicus*, a subspecies of *S. simplex*, by BOND (1934: Fig. 10). BELK & BRTEK (1995) place it in synonymy with *S. simplex*. MAEDA-MARTINEZ et al. (1995) place this species in the '*S. dichotomus*-group', a group of Indian species.

Distribution: It is an Indian streptocephalid species whose range extends into the south-eastern Arabian Peninsula only from Aden.

Remarks: After the manuscript for this paper was written and submitted, a lot of *Streptocephalus simplex* collected in 1877 from the "Réservoir Salomon" in Aden and kept in the collections of the Van Beneden Institute (University of Liège, Belgium) has been sent to me by Michèle Loneux-Walravens, who is thankfully acknowledged for this loan. This material was erroneously registered under the name *Branchipus* nov. sp., no. 5083, 1877. The sample is composed of fully developed males, ovigerous females and numerous juveniles. The morphology of the longer males agrees with the description by BOND (1934): they have very long second antennae, terminating the penes when they are rolled up ventrally, which match with the drawing of the second antenna of the male (see Fig. 10 e, this paper). The total lengths are as follows: males 8.8-10.9 mm (n = 17), females 6.9-9.0 mm (n = 50), immature specimens 5.9-9.5 mm (n = 178). In females, the brood pouches are thin and reach the sixth to seventh abdominal segment. Ovigerous females have 4-11 cysts, indicating that the population is young. The cysts, which had been unknown until now, are light yellow, spherical, with polyhedral depressions bordered by more or less smooth thin ridges. Their mean diameter, measured under SEM, is $241.09 \pm 18.59 \mu\text{m}$ (n = 6), range 217.92-256.21 μm . The appearance as well as the diameter are slightly different from those of the Indian subspecies *Streptocephalus simplex echinus* (diameter 0.20-0.22 mm, ridges quite large with small pores) and *S. simplex longimanus* (diameter 0.21-0.22 mm, ridges like very thick folds) described by MUNUSWAMY et al. (1985). These differences support the distinction that MAEDA-MARTINEZ et al. (1995) made between the species of the *S. dichotomus*-group: *S. echinus*, *S. longimanus* and *S. simplex*. The present sample confirms and defines the location of the samples made by G.E. Hutchinson in February and December 1932 in Aden (material described by BOND 1934). However, more data are needed to compare the Indian and the Yemeni *S. simplex* and clarify whether the subspecies *S. simplex arabicus* is valid.

Order Notostraca Sars, 1867
Family Triopsidae Keilhack, 1909

Triops cancriformis simplex Ghigi, 1921 (Figs 15-16, 37)

Material: Yemen: 3 ♀♀, 3 ♂♂, Kutab, 80 km S of Sana'a, 24.VI.1990, H.J. Dumont.

Remarks: All the shields were more or less broken so measurements are not available. However, specimens are strong and their lengths to telson reach 31.1 mm (a male with a carapace 23.0 mm long). A female reaches 41.7 mm to telson, and 76.3 mm cercopods included.

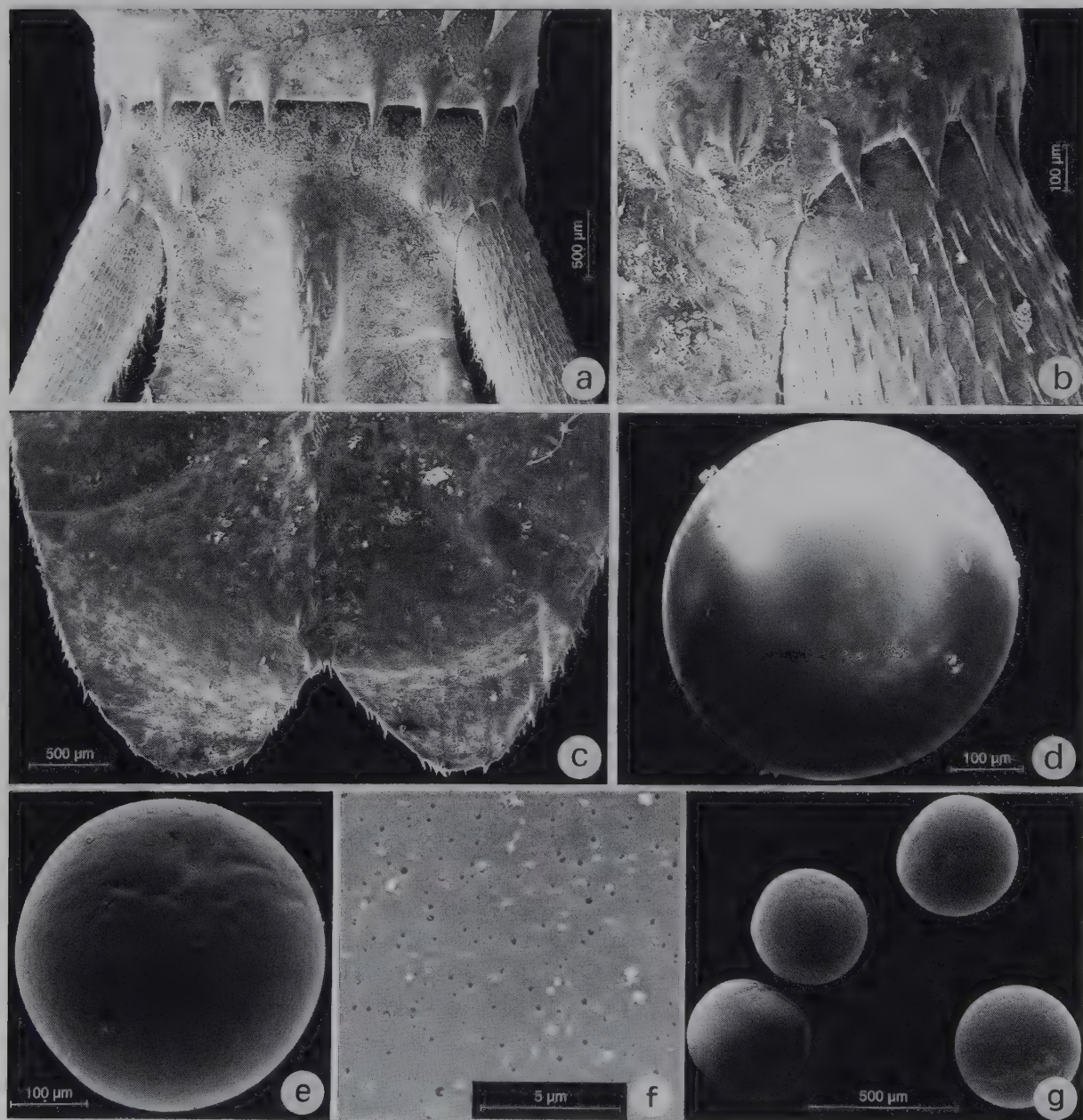


Fig. 15: a-d, *Lepidurus couesii* from Syria: a, ♂, detail of telson with anterior part of anal plate; b, detail of acute spines on telson and cercopods; c, distal part of anal plate (incised); d, cyst. e-g, *Triops cancriformis simplex* from Kutab, Yemen: e, cyst; f, detail of the external porous surface of the cyst shell; g, four cysts.

Description: Number of apodous segments: five in females, five to six in males; number of segments 32-33 in females, 33 in males, number of legs: 47 in both sexes; nuchal organ round or nearly oval (Fig. 16 e). End of the shield carina smooth (Fig. 16 f); telson with strong lateral spines (Figs 16 c-d). Cysts spherical, smooth with small pores (Figs 15 e-g, 37 j), mean cyst diameter $387.3 \pm 11.3 \mu\text{m}$, range 372-408 μm , $n = 13$. By their shape and diameter they resemble the cysts of Moroccan *Triops cancriformis simplex* from the Eastern Plateau (THIÉRY 1987: Fig. 199.3).

Distribution: *Triops cancriformis* is a widely distributed species in the Mediterranean basin. The subspecies *T. c. simplex* extends into North Africa, Morocco (ROUX & THIÉRY 1988), Algeria (GAUTHIER 1928 a), Libya (COLOSI 1922) to Egypt (LONGHURST 1955).

Triops numidicus (Grube, 1865) (Figs 16-18)

Triops granarius Simon, 1886. — Ann. Soc. ent. Fr. (6) 6: 446.

Material: Saudi Arabia: 5 ♀♀ (two ovigerous, with 45-50 cysts per ♀, mean cyst diameter $491.6 \pm 14.4 \mu\text{m}$, $n = 3$), one used for SEM study, 150 km SSW of Riyadh, 13.VI.1959, E. Aichl; 1 ♀, ovigerous, Wadi Durmah, 27.IV.1976, W. Wittmer & W. Büttiker; 2 ♀♀, ovigerous, Hieth, 2.V.1976, W. Büttiker; 60 ♂♂, 2 ♀♀ (one ovigerous with five cysts), Jebel Buwaybiyat, V.1979, W. Büttiker; 4 ♀♀, ovigerous (with 36-42 cysts per ♀, mean cyst diameter $505.8 \pm 14.9 \mu\text{m}$, $n = 15$), 1 ♂, Hanakiyah, 21-25.XI.1984, W. Büttiker; 3 ♂♂, all in a poor state of preservation, Mibhil, 17.IV.1984, W. Büttiker; 3 ♀♀ (two ovigerous, with 5-7 cysts per ♀; first ♀, mean cyst diameter $491.7 \pm 13.5 \mu\text{m}$, $n = 4$; second ♀, mean cyst diameter $606.3 \pm 12.5 \mu\text{m}$, $n = 4$), 8 ♂♂, Wadi Tima, 26.IV.1985, W. Büttiker. — Oman: 2 ♀♀, ovigerous (first ♀ with 25 cysts, mean diameter $588.1 \pm 15.8 \mu\text{m}$, range 550-612.5 μm , $n = 19$; second ♀ with 40 cysts, mean diameter $582.9 \pm 17.5 \mu\text{m}$, range 550-625 μm , $n = 20$), Haylat Daly, 17.III.1990, A.J. Spalton, ONHM 1506.1; 3 ♀♀ (two ovigerous; first ♀ 9.8 mm long, with 5 cysts, mean diameter $595.0 \pm 18.9 \mu\text{m}$, range 575-625 μm , $n = 5$; second ♀ 16.2 mm long, with 13 immature cysts), 5 ♂♂, Lekhatan, 18.III.1990, no collector given; 6 ♂♂, Yalooni Khatan, 18.III.1990, no collector given; 5 ♂♂, Msaaf Yalooni, 19.III.1990, Kasab bin Dooda, ONHM 1506.5; 3 ♀♀ (none ovigerous), 6 ♂♂, Jiddat al-Harasis near Yalooni, site no. 1, 24.III.1990, R. Victor; 7 ♀♀ (none ovigerous), 6 ♂♂, same data but site no. 2, gravel desert; 30 ♀♀ (none ovigerous), 10 ♂♂, Yalooni, 3.IV.1990, M. Laurence; 2 ♀♀ (none ovigerous), 2 ♂♂, Darabyl, 3.III.1992, no collector given, ONHM 2053.1; 1 ♀, ovigerous (with 59 cysts, mean cyst diameter $608.3 \pm 20.4 \mu\text{m}$, range 575-625 μm , $n = 8$), 2 ♂♂, Daratheem, 6.V.1992, no collector given, ONHM 2053.2; 1 ♀, 1 ♂, 3 immatures, Jiddat al-Harasis, 11.III.1995, M. Laurence, ONHM 2438.1; 3 ♀♀ (first cohort, none ovigerous), 7 ♀♀ (second cohort, four ovigerous, with 7-12 cysts per ♀, first ♀ 11.5 mm long, with 12 cysts, mean diameter $490.1 \pm 13.7 \mu\text{m}$, range 475-500 μm , mean diameter of mixed cysts from the other 3 ♀♀ $579.9 \pm 25.4 \mu\text{m}$, range 525-600 μm , $n = 25$), Haylat Yalooni, 25.III.1995, M. Laurence, ONHM 2455.

Remarks: Measurements of specimens are given in Table 1

Description: The species has been known from Arabia for many years (LONGHURST 1955, 1958). It has been named *Triops granarius* in almost all publications, but recently BRTEK & THIÉRY (1995) argued that it was, in fact, a synonym of *T. numidicus* described by GRUBE (1865). While the species is well known (see LONGHURST 1955, RAYNER & BOWLAND 1985, THIÉRY 1987, SEAMAN et al. 1991, MEINTJES et al. 1994), its variability is always discussed, particularly in the number of body rings and apodous rings.

For all the Saudi Arabian samples the number of apodous segments (excluding telson) is: ♀: 9-12, ♂: 14-15; total number of segments: ♀: 36-39, ♂: 38-39; diameter of cysts: range 475-625 μm ; the nuchal organ is rounded and quadrangular with an horizontal base (Figs 16 b, 17 c), telson with numerous small spines and telson of the male covered with numerous acute scales (Figs 16 a, 17 a-b). For measurements and segmentation see Table 1. The relationship between the length of the cephalothoracic shield along its carina and the width of telson (both in mm) is:

$$\text{shield length} = 6.686 \times \text{telson width} + 0.147, r^2 = 0.899, n = 12, \text{mixed } \sigma\sigma \text{ and } \text{♀♀}$$

This equation enables an estimate of the length of specimens to be made (length of shield is isometric with total body length as shown by LONGHURST 1955, THIÉRY 1987, and MEINTJES et al. 1994), from the width of the telson, a part of *Triops* which is strongly chitinous and so often found in sediments when the pond has dried up. It is also possible to estimate their age, and therefore the

date of birth for the cohort (corresponding with the flooding of the pond) with respect to the growth curves described by THIÉRY (1991) and SEAMAN et al. (1991).

Table 1: Measurements (in mm) and segmentation of *Triops numidicus* specimens from Saudi Arabia and Oman.

| Location and date | Sex | n | Carapace shield length | Telson width | Number of body rings (excluding telson) | | |
|----------------------------------------------------|-----|----|------------------------|--------------|-----------------------------------------|---------|---------|
| | | | | | Total | Apodous | Exposed |
| Saudi Arabia | | | | | | | |
| 150 km SSW of Riyadh, 13.06.1959 | ♀ | 5 | 16.0-22.0 | 2.5-3.1 | 38-39 | 9-12 | 24-29 |
| Wadi Durmah, 27.04.1976 | ♀ | 1 | 20.1 | — | — | — | — |
| Hieth, 02.05.1976 | ♀ | 2 | 14.8-16.5 | — | — | — | — |
| Jebel Buwaybiyat, 05.1979 | ♀ | 2 | 9.5 | 1.40-1.56 | 37-39 | 10-12 | 25 |
| | ♂ | 60 | 8.4-11.5 | 1.50-1.89 | 37-41 | 13-15 | 28-32 |
| Mibhil, 17.04.1984 | ♂ | 3 | 9.4-10.7 | 1.48 | — | 13-14 | 25-26 |
| Hanakiyah, 25.11.1984 | ♀ | 4 | 12.0-14.1 | 1.6-2.1 | 36-39 | 11-12 | 25-28 |
| | ♂ | 1 | 14.1 | 1.9 | 38 | 14 | 29 |
| Wadi Tima, 26.04.1985 | ♀ | 3 | 9.4-9.8 | 1.3-1.6 | 37-38 | 12 | 24 |
| | ♂ | 8 | 10.0-11.2 | 1.6-2.0 | 38-39 | 14 | 23-28 |
| Oman | | | | | | | |
| Haylat Daly, 17.03.1990 | ♀ | 2 | 17.8-20.2 | 3.1-3.4 | 38-39 | 8-9 | 21-25 |
| | ♂ | 4 | 18.3-21.0 | 3.0-3.6 | 40-41 | 11-12 | 20-24 |
| Lekhatan, 18.03.1990 | ♀ | 3 | 11.5-19.8 | 1.5-3.1 | 40-41 | 9 | 24-29 |
| | ♂ | 5 | 19.6-21.1 | 3.0-3.4 | 41-42 | 10-12 | 23-31 |
| Yalooni Khatan, 18.03.1990 | ♂ | 6 | 18.4-20.9 | 2.8-3.5 | 41-42 | 10-11 | 29-31 |
| Msaافر Yalooni, 19.03.1990 | ♂ | 5 | 13.0-17.8 | 1.9-3.2 | 40-41 | 10-12 | 27-30 |
| Jiddat al-Harasis, site no. 1, 24.03.1990 | ♀ | 3 | 16.1-16.9 | 2.6-2.8 | 40 | 8-9 | 27 |
| | ♂ | 6 | 15.0-18.4 | 2.5-3.0 | 39-42 | 9-11 | 26-30 |
| Same, site no. 2 | ♀ | 7 | 13.3-18.1 | 2.1-2.8 | 38-41 | 8-9 | 24-28 |
| | ♂ | 6 | 14.1-19.1 | 2.4-3.0 | 40-41 | 9-12 | 27-30 |
| Yalooni, 03.04.1990 | ♀ | 30 | 9.1-13.8 | — | — | 6-8 | — |
| | ♂ | 10 | 9.4-17.1 | — | — | 8-9 | — |
| Darabyl, 03.05.1992 | ♀ | 2 | 16.8-21.0 | 2.1-3.3 | 40 | 9 | 27-30 |
| | ♂ | 2 | 12.8-17.4 | 1.9-2.5 | 40-42 | 10 | 25-26 |
| Daratheem, 06.05.1992 | ♀ | 1 | 25.8 | 4.1 | 40 | 9 | 30 |
| | ♂ | 2 | 26.0-28.0 | 4.2-4.6 | 40-41 | 10 | 29-30 |
| Jiddat al-Harasis, 11.03.1995 | ♀ | 1 | 8.1 | 1.1 | 39 | 9 | 25 |
| | ♂ | 1 | 9.2 | 1.4 | 41 | 12 | 28 |
| | im. | 3 | 5.9-7.0 | 0.9-1.0 | 37-40 | 9-11 | 15-27 |
| Haylat Yalooni, 1 st cohort, 25.03.1995 | ♀ | 3 | 15.7-17.2 | 2.43-2.84 | 38-41 | 9 | 28-31 |
| Haylat Yalooni, 2 nd cohort, 25.03.1995 | ♀ | 7 | 11.0-13.0 | 1.62-2.03 | 39-41 | 8-9 | 27-31 |
| | ♂ | 3 | 11.1-13.5 | 1.62-2.03 | 39-41 | 10-11 | 27-28 |

Based on a large collection of specimens coming from Morocco, Sahara, Japan, and from literature data, THIÉRY (1987) hypothesised that *Triops numidicus* (= *T. granarius*) presented a morphological polymorphism with intra-species variation of apodous segments in males (clinal variation) paired with climatic features, the number of apodous segments growing with aridity. The males found in Saudi Arabia, with 14-15 apodous segments, take their place in this relationship (they inhabit temporary waters in an eremic area with annual rainfall < 100 mm, SIRAJ 1984). However, the Oman specimens clearly do not fit with this model. They have fewer apodous body rings (Fig. 18) and more total body rings than the Arabian individuals. The number of apodous body rings is 8-9, exceptionally 6, in females vs. 9-12 in Arabian females and 9-12, exceptionally 8, in males vs. 13-15 in Arabian males. This hiatus cannot be explained by the clinal variation vs. climatic features theory. Are the *Triops* from Saudi Arabian and Oman two strains, the former of Sahara origin (number of apodous body rings similar to that in specimens from Morocco and Sahara) and the latter of Asian origin? GURNEY (1921, 1925) had noted similar apodous body rings

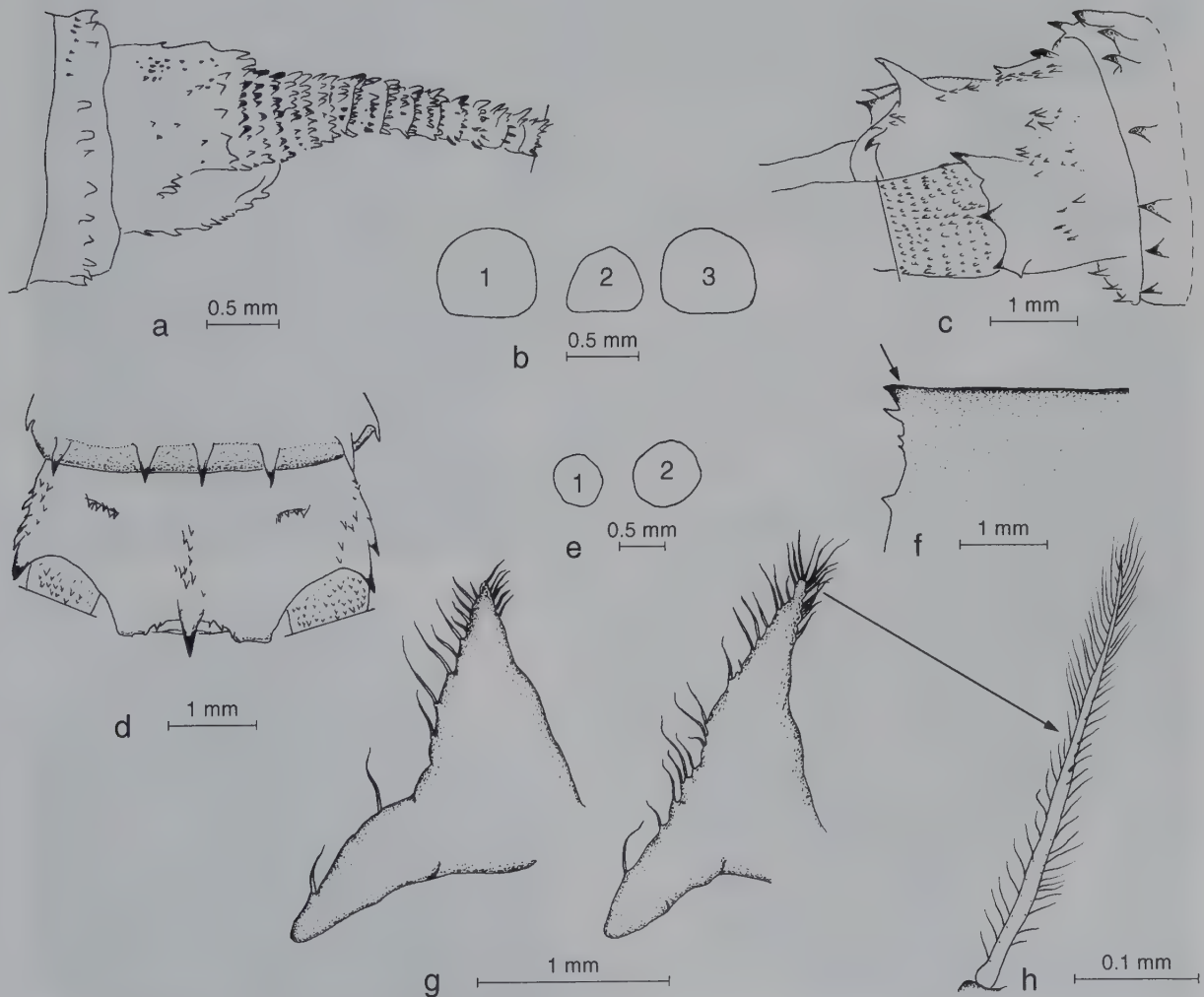


Fig. 16: a-b, *Triops numidicus* from Jebel Buwaybiyat, Saudi Arabia: a, telson of ♂, left lateral view; b, variation in shape of nucal organ in ♂ (1 and 3) and in ♀ (2). c-f, *Triops cancriformis simplex* from 60 km south of Sana'a, Yemen: c, telson of ♀, right lateral view; d, telson of ♂, dorsal view; e, shape of the nucal organ of ♂ (1) and ♀ (2); f, distal part of the smooth carina (arrow) of the ♀ headshield, right lateral view. g-h, *Lepidurus couesii* from Syria: g, exopodite of the first leg in two ♂♂; h, detail of a seta.

in Mesopotamian and China specimens; he named the species *T. asiaticus*, today a synonym of *T. numidicus*. This one extends over to the east into Japan (see numbers of body rings recorded in THIÉRY 1987), and to Africa in Somalia (see BOUVIER 1899; *Triops* with a similar number of

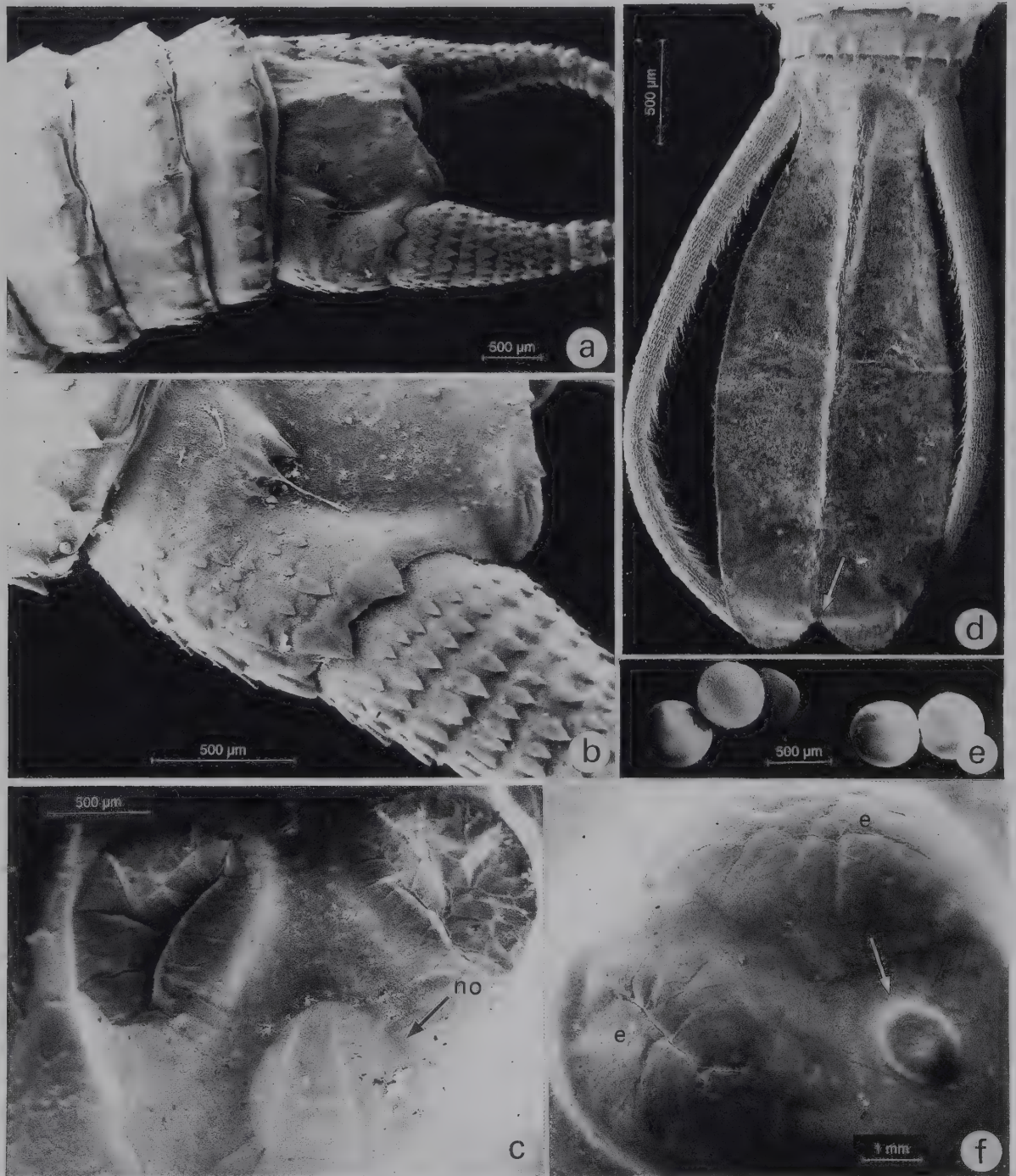


Fig. 17: Notostraca: a-c, *Triops numidicus* from Saudi Arabia: a, ♂, left lateral view of end of abdomen showing the telson and the base of the cercopods; b, same, detail of large spines on telson and cercopod; c, dorsal view of head, with eyes and large nuchal organ (n.o.). d-f, *Lepidurus apus* from Syria: d, ♀, dorsal view of telson with supra-anal plate and cercopods; e, cysts; f, dorsal view of head with eyes (e.) and ovoid nuchal organ (arrow).

apodous body rings). Further research must provide new data to support or refute this hypothesis. If the strains hypothesis is true, is their distribution possibly linked with dispersal factors such as the general wind circulation over the southern peninsula reaching into the eastern part of Africa, i.e. Somalia (see the main trajectories for dust transport by monsoon in MIDDLETON et al. 1986)?

Distribution: *T. numidicus* is widespread in west, north and south Africa (COLOSI 1923, THIÉRY 1987, RAYNER & BOWLAND 1985), in the Mesopotamian region extending in Asia to Japan (GURNEY 1921, 1925; UÉNO 1940; KARANDE & INAMDAR 1959), also in some Mediterranean islands such as Majorca (Thiéry, unpublished) and Sicily (BRTEK & THIÉRY 1995). In neighbouring countries, *Triops numidicus* is present in Palestine (YARON 1964, Thiéry & Ortal unpublished), in north-east Africa in Somalia (WEDENISSOW 1895, BOUVIER 1899, COLOSI 1923), in Eritrea (DEL PRATO 1896), and in Sudan (RZÓSKA 1961). Considering its above mentioned distribution and the eremic climate prevailing in Oman (Wahiba Sands desert) the numerous Notostraca (430 unidentified specimens not seen) collected by BÜTTIKER & BÜTTIKER (1988) could be attributed without any doubt to *Triops numidicus*.

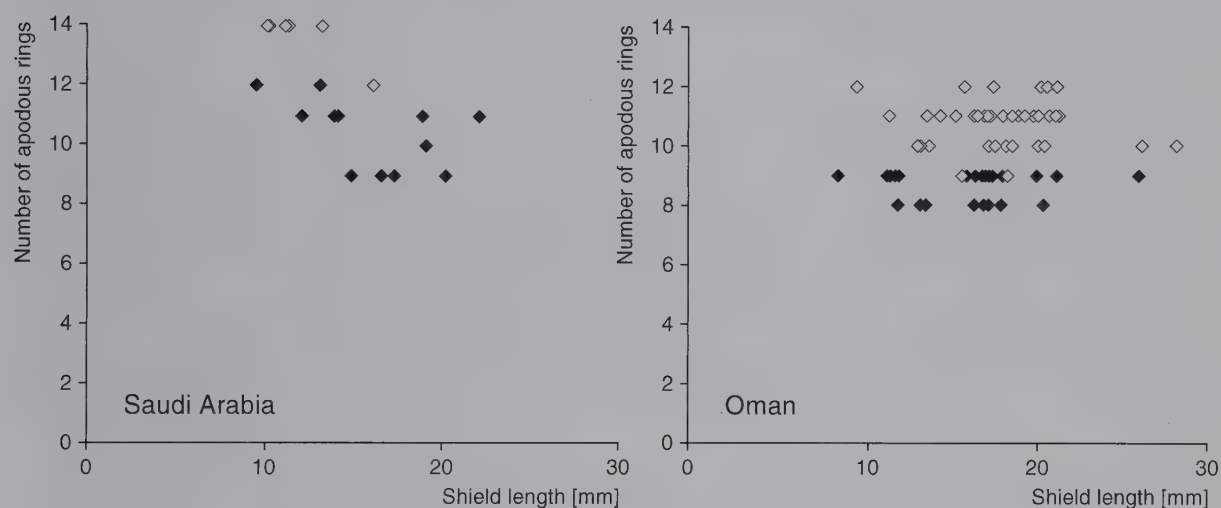


Fig. 18: Relationship between the number of apodous body rings and the carapace shield length (in mm) of *Triops numidicus* ♂♂ (open symbols) and ♀♀ (closed symbols) compared between specimens from Saudi Arabia and Oman.

Lepidurus couesii Packard, 1875 (Figs 15-17, 19, 37)

? *Lepidurus apus lubbocki* Brauer, 1873

Material: Syria: 1 ♂, 4 ♀♀ (two ovigerous), Damascus-Qunaitra Road, 20.III.1980, F. Krupp & W. Schneider; 20 ♂♂, 11 ♀♀ (nine ovigerous with 23-39 cysts), same data; 17 ♂♂, 9 ♀♀ (eight ovigerous), Wadi al-Harir, 25 km NE of Deraa, 25.III.1977, R. Kinzelbach.

Remarks: Measurements of specimens are given in Table 2.

Description: The Syrian specimens, with 27-29 trunk segments and 5-6 apodous segments, show a sexual dimorphism in the ratio of width of telson to length of anal plate (both in mm, see Fig. 19). In the male the equation is:

$$\text{width} = 0.139 \times \text{length} + 1.368 \quad (n = 29, r^2 = 0.748)$$

while in the female it is:

$$\text{width} = 0.239 \times \text{length} + 1.092 \quad (n = 18, r^2 = 0.722)$$

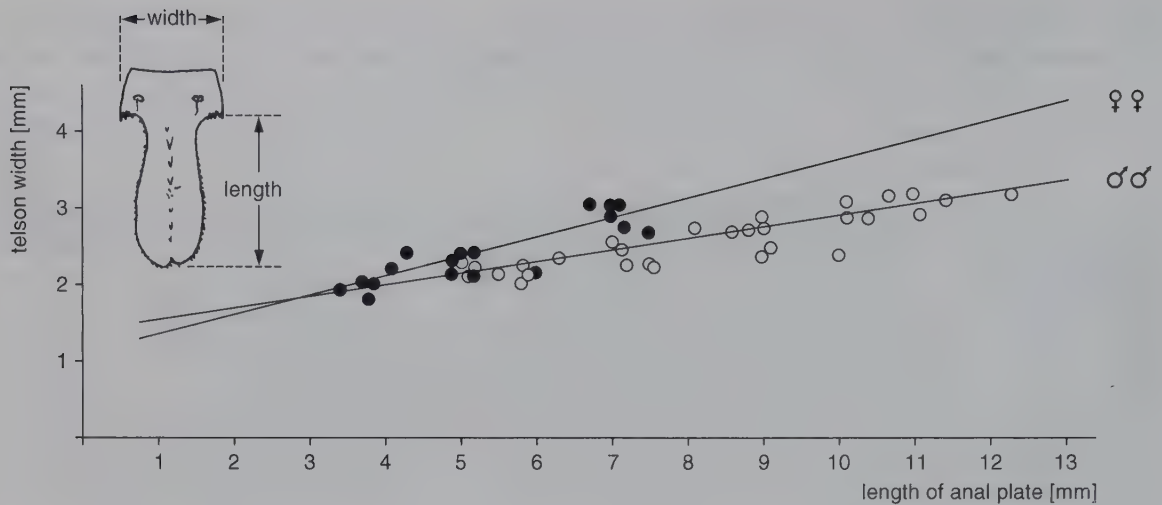


Fig. 19: *Lepidurus couesii* from Syria: Ratio of telson width to length of anal plate in ♀♀ (closed circles) and in ♂♂ (open circles). Specimens from Damascus-Qunaitra Road, 20.III.1980, and from Deraa, 25 km NE of Nahr al-Harir, 25.III.1977. Equations see text.

The end of the supra-anal plate has a median incision, giving it a bilobed appearance (Figs 15 c, 17 d) in more than 60 % of the specimens while it is more or less rounded (sometimes slightly incised) in European and North African *Lepidurus*. This telson morphology appears also in the north-eastern Palestine specimens from the Golan heights (Thiéry, unpublished data). The shape of the exopodite of the first leg is elongated distally and proximally (Figs 16 g-h) and is similar to that of Moroccan specimens (THIÉRY 1987). BRTEK et al. (1984) consider this character as the most important one to discriminate *L. apus* from *L. couesii*. However, we show on Moroccan and French populations a great variability and transitional forms (THIÉRY 1987), so that the taxonomical situation is actually unclear. Cysts are spherical and smooth with a diameter ranging from 463 to 510 μm (Figs 15 d, 17 e, 37 a). By their diameter and surface ornamentation they are close to those of Moroccan and French *Lepidurus* (THIÉRY 1987, THIÉRY & GASC 1991, THIÉRY et al. 1995).

Distribution: European species widely distributed around the Mediterranean basin but concentrated in sub-humid areas, particularly in foothills or mountains.

Table 2: Measurements (in mm) and segmentation of *Lepidurus couesii* specimens from Syria. i.a.p. = Number of specimens with incised anal plate.

| Location and date | Sex | n | Shield | | Telson | | No. of legs | Number of body rings (excluding telson) | | | i.a.p. |
|------------------------------------------------------------------|-----|----|-----------|-----------|----------|---------|-------------|-----------------------------------------|---------|---------|--------------------------|
| | | | Length | Width | Length | Width | | Total | Apodous | Exposed | |
| Wadi al-Harir, 25 km NE of Deraa, 25.03.1977 | ♀ | 9 | 16.0-23.8 | 8.2-16.7 | 3.8-7.5 | 2.0-2.8 | — | 26-27 | 5-6 | 3-6 | 7 |
| | ♂ | 17 | 16.5-22.0 | 10.0-16.1 | 5.0-11.4 | 2.1-3.0 | — | 27 | 5-6 | 3-7 | 14 |
| Damascus-Qunaitra Road, 1 st sample, 20.03.1980 | ♀ | 4 | 18.8-23.2 | 13.0-14.5 | 4.6-5.3 | 2.7-3.0 | 39-41 | 27 | 5-6 | 7-10 | broken anal plates |
| | ♂ | 1 | 23.9 | 18.5 | broken | 3.1 | 42 | 27 | 6 | 8 | |
| Damascus-Qunaitra Road, 2 nd sample, 20.03.1980 | ♀ | 11 | 14.5-23.8 | 9.0-13.6 | 3.4-7.2 | 1.8-3.0 | — | 26-28 | 5-6 | 6-10 | 10 |
| | ♂ | 20 | 14.5-22.9 | 9.5-17.1 | 5.1-12.3 | 2.0-3.1 | — | 26-28 | 6 | 5-11 | 16 |

Order **Spinicaudata** Linder, 1945Family **Cyzicidae** Stebbing, 1910*Cyzicus gihoni* Baird, 1859 (Figs 20-22, 36-37)

Material: Syria: 1 ♂, Wadi al-Harir, 25 km NE of Deraa, 25.III.1977, R. Kinzelbach; 38 ♂♂, 29 ♀♀, Damascus-Qunaitra Road, 20.III.1980, F. Krupp & W. Schneider; 13 ♂♂, 1 ♀, Busra Theater, 24.VI.1980, F. Krupp & W. Schneider.

Remarks: Measurements of specimens are given in Table 3.

Description: Cysts spherical and smooth (Figs 21 d-f, 37 g) with a mean diameter of $153.3 \pm 6.3 \mu\text{m}$, range 135-168 μm . The cyst shell looks like a network of thin radiating and entangled hair (Figs 21 g-h). This distinctive character has been described in *Cyzicus grubei* in Spain (ALONSO & ALCARAZ 1984), in *C. bucheti* in Morocco (Thiéry, unpublished), and in *C. tetracerus* in France (THIÉRY & GASC 1991) and in Slovakia (THIÉRY et al. 1995), so it confirms that the hairy structure of the vitelline envelope (sensu TOMMASINI & SCANABISSI SABELLI 1989) is a *Cyzicus* genus character. This common morphology and diameter add a new taxonomic element to support the variability theory within the *Cyzicus* group (vicariant species or polymorphism as in the notostracan *Triops numidicus*?).

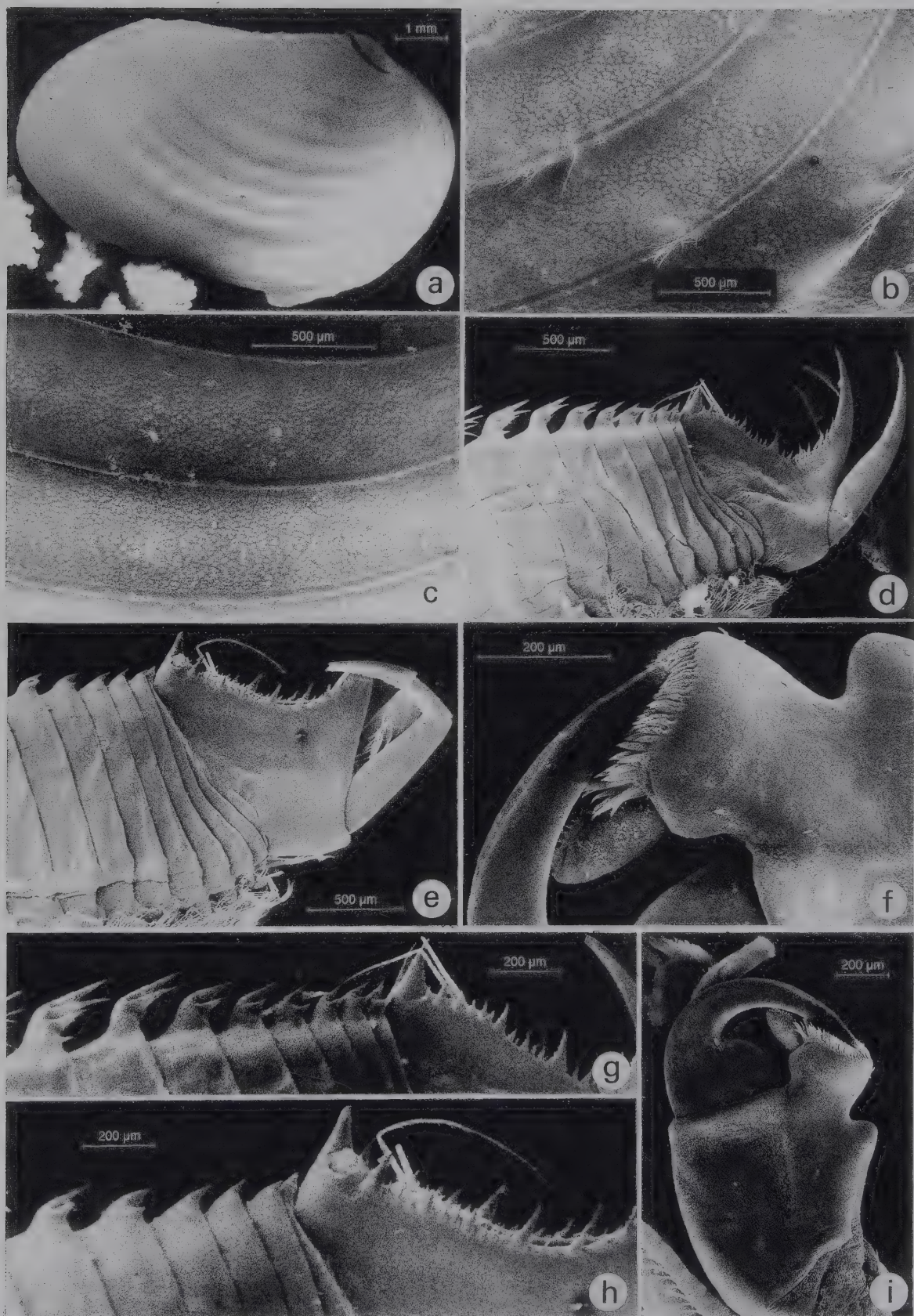
Distribution: Species common in Palestine (HARTLAND-ROWE 1967) and probably in the neighbouring countries. However, as shown by STRASKRABA (1965 b), many characters used by DADAY (1914) and other authors, such as BAIRD (1859, 1862), BARROIS (1892) and COLOSI (1922), for the distinction of *Cyzicus* species are subject to rather substantial growth as well as individual and local variability. So, *Cyzicus gihoni* might be placed in synonymy with others species described from the Levant: *C. hierosolymitanus* Fish., *C. hierosolymitanus* var. *rollei* (Ish.), *Cyzicus* (= *Caenestheriella*) *educta* Daday, *C. ehrenbergii* Daday, *C. aegyptiacus* Daday, and *C. melitensis* (Baird) from Malta. All these species, more or less synonymous, take their place in a larger group which includes Mediterranean species such as *C. tetracerus*, *C. grubei*, *C. algericus*, *C. cyrenaicus* (Vecchi), *C. cycladoides* and *C. bucheti*. A taxonomical revision of the *Cyzicus* genus in the Mediterranean basin is needed.

Table 3: Measurements (in mm) of *Cyzicus gihoni* specimens from Syria.

| Location and date | Sex | n | Valve length (= L) | | Valve height (= H) | | Ratio L/H | Number of growth lines |
|----------------------------------------------|-----|----|--------------------|----------------|--------------------|---------------|-----------|------------------------|
| | | | Range | Mean \pm SD | Range | Mean \pm SD | | |
| Wadi al-Harir, 25 km NE of Deraa, 25.03.1977 | ♀ | 1 | 7.8 | — | 5.0 | — | 1.56 | 16 |
| Damascus-Qunaitra Street, 20.03.1980 | ♀ | 29 | 4.6-10.1 | 8.7 ± 1.2 | 3.1-7.1 | 5.9 ± 0.9 | 1.33-1.64 | 11-14 |
| | ♂ | 38 | 6.5-10.3 | 8.9 ± 0.8 | 4.9-7.0 | 6.0 ± 0.5 | 1.31-1.55 | 14-15 |
| Busra Theater, 24.06.1980 | ♀ | 1 | 11.6 | — | 7.7 | 1.51 | — | ♀/♂ mixed: 22-25 |
| | ♂ | 13 | 12.1-14.8 | 13.0 ± 0.8 | 7.9-9.9 | 8.5 ± 0.6 | 1.42-1.60 | |

Eocyclus sp. (aff. *plumosus*) (Figs 23-26, 37)

Material: Saudi Arabia: 4 ♂♂, 5 ♀♀, 150 km SSW of Riyadh, 13.VI.1959, E. Aichl; 10 ♂♂, Wadi Tima, 26.IV.1985; 1 ♂, Wadi Rimah 5.V.1985, W. Büttiker; 7 ♂♂, 7 ♀♀, (one ♂, length 7.0 mm, height 4.7 mm, 14 growth lines, and one ovigerous ♀, length 5.9 mm, height 4.1 mm, 14 growth lines, used for SEM study), Qaba, 6.V.1985, W. Büttiker. — Oman: 45 ♂♂ and ♀♀ mixed (some ovigerous ♀♀ with 44-46 cysts), Wadi al-Batah, 22.II.1986, W. Büttiker; 2 ♂♂, 3 ♀♀, Shaqq, 7.III.1986, W. Büttiker; 7 ♂♂, Bukaratub, 20.IV.1987, M.D. Gallagher, ONHM 729.1; 8 ♂♂, 4 ♀♀ (one ovigerous with



66 cysts, 31 left and 35 right, mean diameter of four cysts on the vial bottom $128.7 \pm 1.44 \mu\text{m}$, range 127.5-130 μm), 5 spms in a poor state of conservation, 20 km from Haima, 23.III.1990, collector not given; 8 ♂♂, 6 ♀♀ (two ovigerous, specimens dried), Huqf, 20.III.1991, E.R.L. Jones, ONHM 1793; 11 ♂♂, 14 ♀♀ (eleven ovigerous), Huqf, Jiddat al-Harasis, same date and collector, ONHM 1793; 19 ♂♂, 7 ♀♀ (four ovigerous), Yalooni, pool, 3.IV.1994, collector not given; 5 ♂♂, Wadi Dirif, 27.VI.1994, E.R.L. Jones, ONHM 2360; 1 ♀, without eggs, Jiddat Haylat Yalooni, 25.III.1995, M. Laurence, ONHM 2457.

Remarks: Measurements of specimens are given in Table 4.

Description: Shell ovate, translucent and finely granulose, colour yellow to white. Number of growth lines for the longer specimens 26-30, their number being linked with the length of the valves (and so to their age/number of molts) as shown for other Spinicaudata (see THIÉRY 1987, and section on *Eulimnadia* in this paper). The length/height ratio is from 1.4 to 1.6, as for the

Table 4: Measurements (in mm) of *Eocyclus* sp. (aff. *plumosus*) specimens from Saudi Arabia and Oman.

| Location and date | Sex | n | Valve length (= L) Range Mean ± SD | | Valve height (= H) Range Mean ± SD | | Ratio L/H | Number of growth lines |
|------------------------------------------------|-----|----|--------------------------------------------|-------------|--------------------------------------------|-------------|-----------|---------------------------|
| Saudi Arabia | | | | | | | | |
| 150 km SSW of Riyadh, 13.06.1959 | ♀ | 5 | 4.8-6.6 | 5.6 ± 0.7 | 3.3-4.2 | 3.8 ± 0.4 | 1.34-1.57 | 10-13 |
| | ♂ | 4 | 6.2-7.0 | 6.6 ± 0.3 | 4.1-4.5 | 4.2 ± 0.2 | 1.47-1.59 | 13 |
| Wadi Tima, 26.04.1985 | ♂ | 10 | 6.5-7.4 | 6.9 ± 0.3 | 4.1-4.9 | 4.4 ± 0.3 | 1.49-1.63 | 15-16 |
| Wadi Rimah, 5.05.1985 | ♂ | 1 | 7.2 | — | 4.7 | — | 1.53 | 14 |
| Qaba, 6.05.1985 | ♀ | 7 | 6.0-7.2 | 6.8 ± 0.4 | 4.1-5.1 | 4.7 ± 0.3 | 1.38-1.52 | 14-16 |
| | ♂ | 7 | 6.5-7.4 | 6.9 ± 0.3 | 4.2-5.1 | 4.7 ± 0.3 | 1.41-1.60 | 15-16 |
| Jebel Said, 60 km SE of Medinah, 13.11.1986 | ♀ | 1 | 5.5 | — | 3.9 | — | 1.41 | 15 |
| | ♂ | 1 | 6.8 | — | 4.4 | — | 1.54 | 15 |
| Oman | | | | | | | | |
| Wadi al-Batah, 22.02.1986 | ♀ | 5 | 2.4-4.1 | 3.3 ± 0.7 | 1.8-2.5 | 2.1 ± 0.3 | 1.33-1.66 | 6-8 |
| Shaqq, 07.03.1986 | ♀ | 3 | 6.4-6.9 | 6.7 ± 0.3 | 4.1-4.5 | 4.3 ± 0.2 | 1.53-1.58 | 10-11 |
| | ♂ | 2 | 5.8-7.1 | — | 3.7 ± 4.3 | — | 1.56 | 10-11 |
| Bukaratub, 20.04.1987 | ♂ | 7 | 5.89-6.44 | 6.10 ± 0.17 | 3.69-4.11 | 3.85 ± 0.15 | 1.53-1.62 | 26-30 |
| 20 km from Haima, 23.03.1990 | ♀ | 4 | 3.56-4.11 | 3.79 ± 0.23 | 2.46-2.60 | 2.49 ± 0.07 | 1.44-1.57 | 10-11 |
| | ♂ | 8 | 4.38-4.93 | 4.60 ± 0.19 | 2.87-3.15 | 3.02 ± 0.11 | 1.45-1.57 | 13-16 |
| Huqf, 20.03.1991 | ♀ | 6 | 4.52-5.20 | 4.81 ± 0.26 | 3.15-3.56 | 3.33 ± 0.16 | 1.36-1.48 | 13-16 |
| | ♂ | 8 | 5.20-6.30 | 5.63 ± 0.44 | 3.42-4.24 | 3.79 ± 0.28 | 1.42-1.53 | 14-16 |
| Huqf, Jiddat al-Harasis, 20.03.1991 | ♀ | 14 | 4.11-5.20 | 4.59 ± 0.32 | 2.60-3.42 | 3.07 ± 0.26 | 1.41-1.57 | 10-12 |
| | ♂ | 11 | 5.48-6.16 | 5.63 ± 0.20 | 3.56-4.11 | 3.65 ± 0.17 | 1.46-1.61 | 12-14 |
| Yalooni, pool, 03.04.1994 | ♀ | 7 | 4.52-4.79 | 4.61 ± 0.10 | 2.87-3.01 | 2.93 ± 0.07 | 1.54-1.61 | 10-13 |
| | ♂ | 19 | 4.38-5.75 | 4.89 ± 0.31 | 2.87-3.83 | 3.13 ± 0.23 | 1.50-1.61 | 11-15 |
| Wadi Dirif, 27.06.1994 | ♂ | 5 | 5.61-6.43 | 5.99 ± 0.35 | 3.69-4.24 | 3.85 ± 0.22 | 1.51-1.70 | 13-15 |
| Jiddat Haylat Yalooni, 25.03.1995 | ♀ | 1 | 2.60 | — | 1.92 | — | 1.36 | 9 |

Fig. 20: *Cyzicus gihoni* from Syria: a, right lateral view of ♀ valve; b, same, detail of growth lines and surface reticulation in anterior part of valve; c, same, in central part of valve; d, left lateral view of end of abdomen and telson of ♀; e, same for another ♀ (cercopods are broken); f, detail of tip of clasper; g, detail of dorsal spines of the last segments of ♀; h, same for another ♀; i, first leg of ♂ modified into clasper.

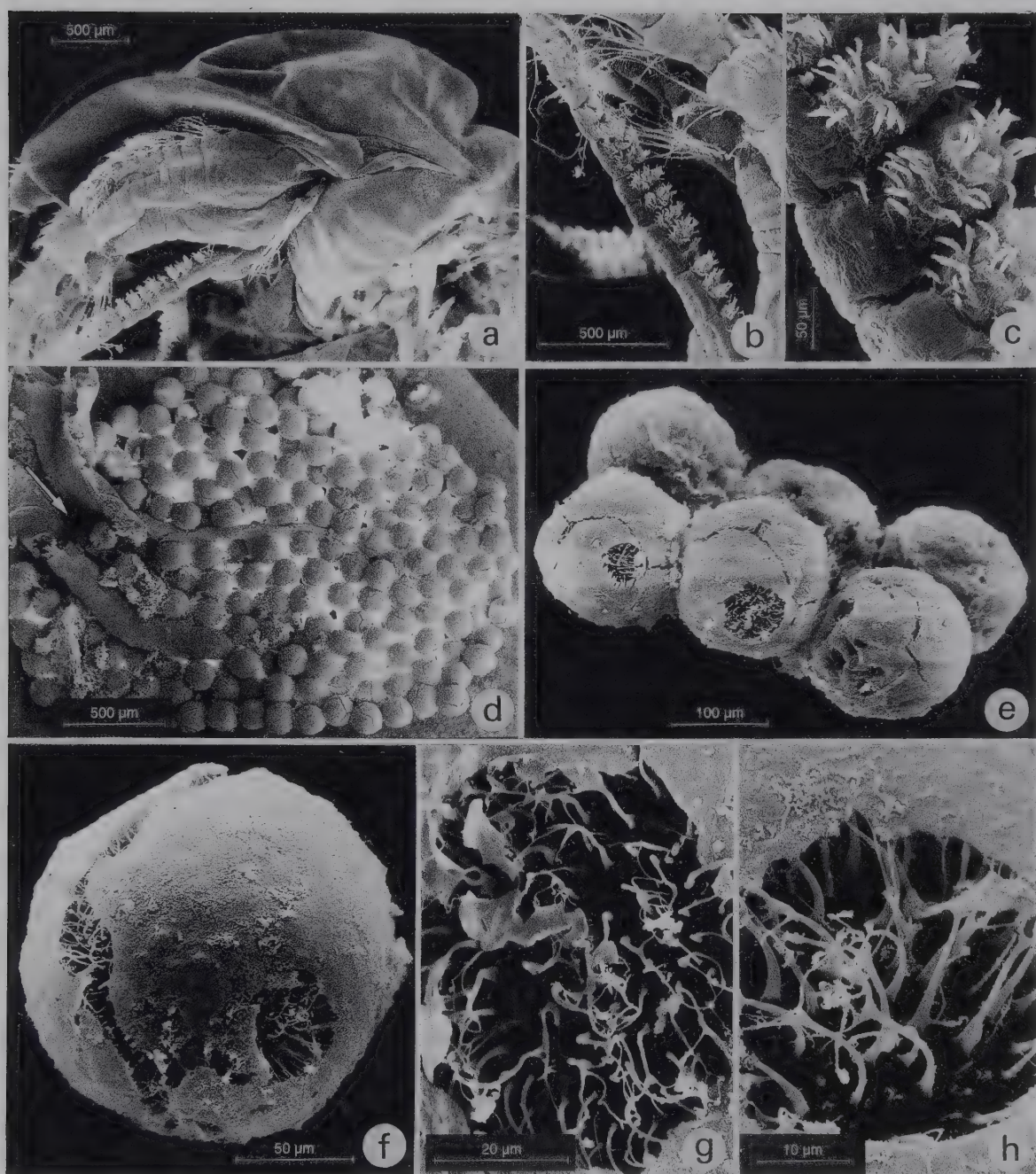


Fig. 21: *Cyzicus gihoni* from Syria: a, left lateral view of head, ♀; b, detail of first antenna; c, detail of sensory papillae on first antenna; d, part of a clutch of a mature ♀, stuck in mucus (white) with the two ovigerous epipodites modified into flabellum (arrow); e, part of another clutch with six stuck cysts; f, whole cyst with its thin external membrane cracked; g, detail of the tertiary covering, the 'hairy' layer; h, same, more enlarged.

Moroccan *E. saharicus* (Thiéry, unpublished), a species described from Mauritania and western Sahara by GAUTHIER (1937). Sexual dimorphism, in head shape: the rostrum of the male is spatulate while it is more acute in the female (Figs 26 e-j), and in valves length: smaller in females than in males (see Table 4). Following characters do not show a sexual dimorphism: first antenna

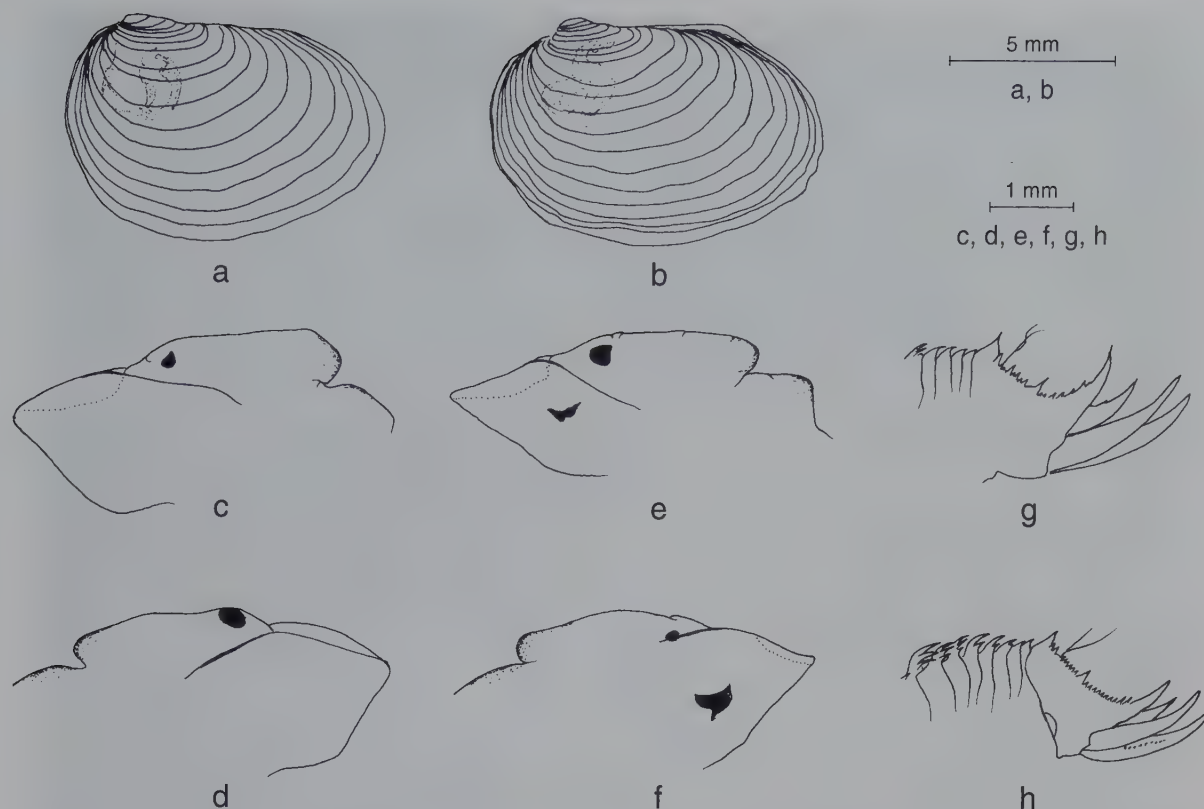


Fig. 22: *Cyzicus gihoni*: a, shell in left lateral view, ♂; b, same, ♀; c-d, head rostrum in left and right lateral views, ♂; e-f, same, ♀; g, telson in left lateral view, ♂; h, same, ♀.

uniramous, with 17-19 sensory lobes bearing sensory papillae on their margins; second antenna biramous, the anterior ramus with 13-14 segments and the posterior one with 14-15 segments. Each segment bears six (sometimes seven) spines on its dorsal side and long thin setae on the ventral side. The numeration of dorsal spines from base to tip is: 6 / 6 / 6 / 6 / 6 / 6 / 7 / 6 / 7 / 5 / 5 / 3 / 2 / 1; trunk with 20 segments and 20 pairs of legs. First and second pair of legs of male modified into claspers and 9th and 10th of the female modified into ovigerous corn with a flabellum. Dorsal trunk armature, composed of spines and laterally of setae, as follows: (from telson to frontal) 1₍₀₎ / 1₍₀₎ / 1₍₀₎ / 1₍₀₎ / 1₍₀₎ / 1₍₃₎ / 1₍₄₋₅₎ / 1₍₃₎ / 1₍₃₎ / 1₍₂₎ / 1₍₀₎ / 0₍₀₎ etc. (numbers of setae on one side in brackets); telson with 13-20 unequal denticles. Furcal claw with 9-12 plumose setae and ends with short spinules. Cysts are spherical, with a bumpy surface (Figs 25, 37 e), diameter range 112-117 µm. By their morphological pattern and diameter, these cysts are close to the cysts of the Saharan species *Eocyclus saharicus* (THIÉRY 1987: Figs 198 f-g). This surface structure has also been described in *E. orientalis* by DADAY (1914) as “Ova membrana concinne granulata tecta”, and described from SEM studies by THIÉRY et al. (1995: Figs 13 h-j). It is hypothesised that the bumpy surface might be a distinctive character for the genus *Eocyclus*.

Distribution: Like in *Cyzicus* and other Spinicaudata (see *Eulimnadia*), the genus *Eocyclus* presents a variability in many characters used in systematics. Although the specimens from Saudi Arabia and Oman show relatively little variability in the structure and shape of the telson, valves, claspers of males and head rostrum in males and females, these characters are insufficient to allow a specific determination. A revision of the genus (including *Caenestheria* Daday) seems to be

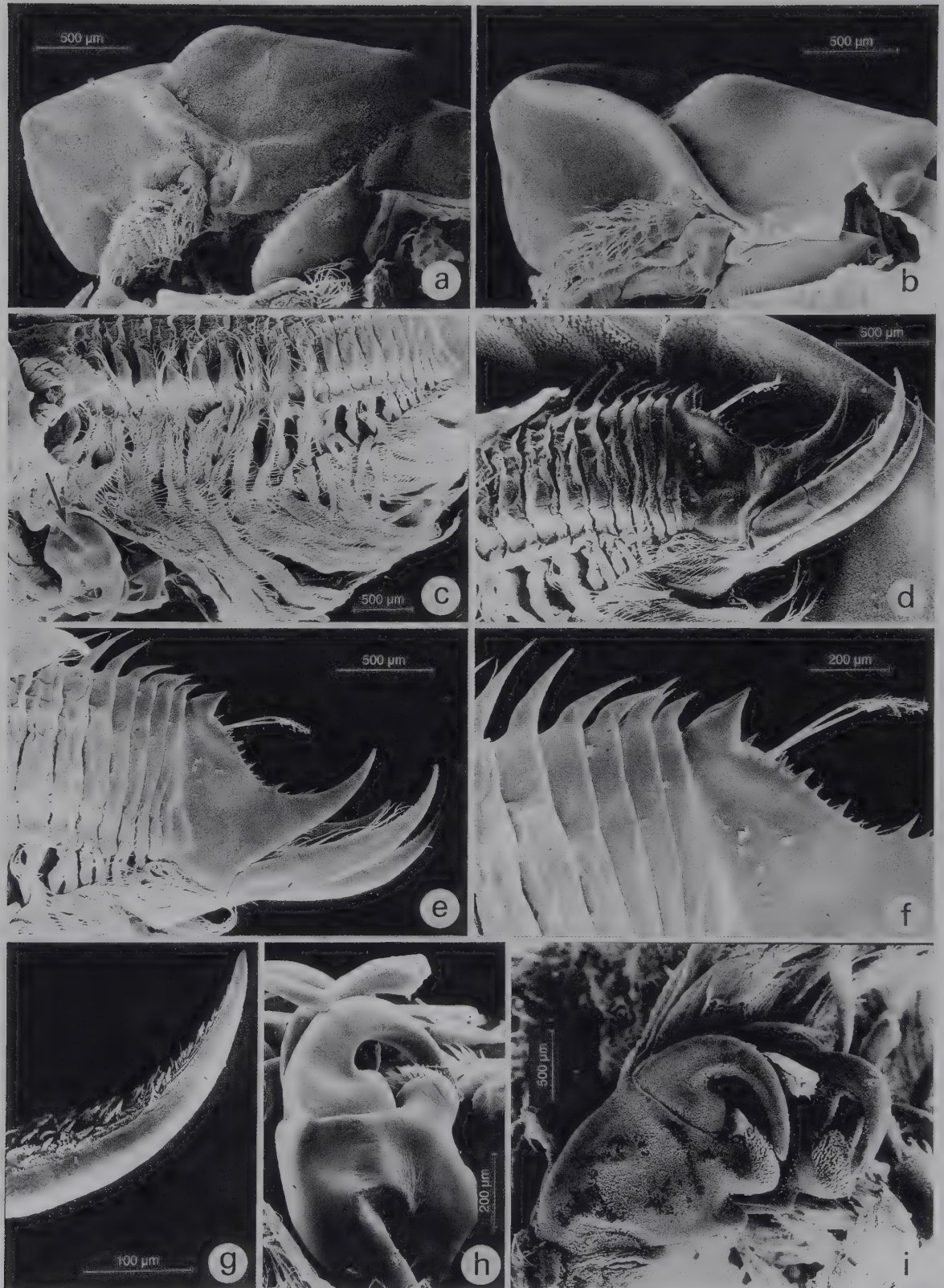


Fig. 23: *Eocyclus* sp., ♂: a, left lateral view of head showing the spatulate rostrum; b, same for another ♂; c, left lateral view of appendages showing the first and second thoracopods modified into claspers (arrow); d, left lateral view of posterior part of the trunk and telson with left valve removed; e, left lateral view of the last abdominal segments and telson; f, detail of trunk armature

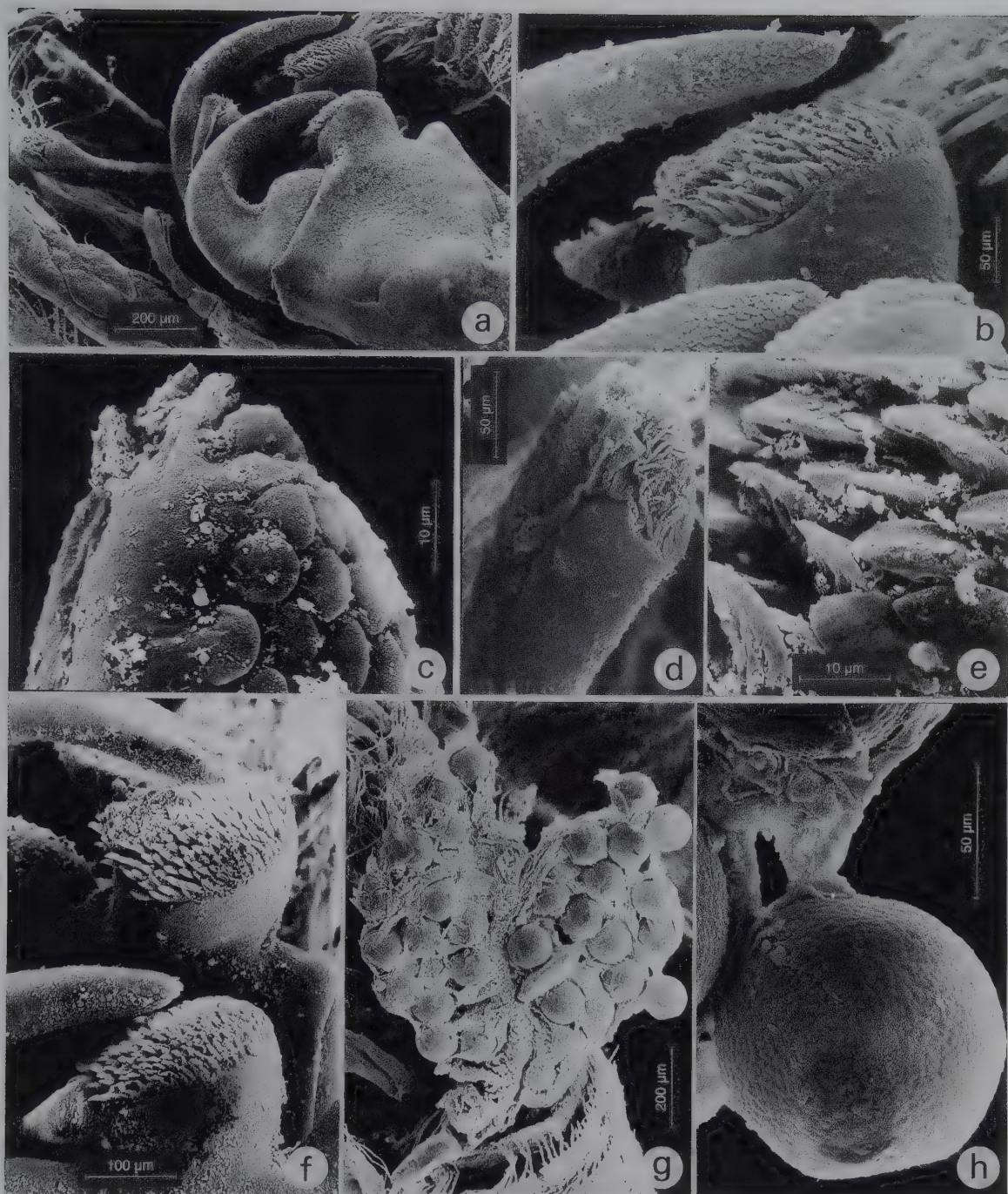


Fig. 24: *Eocycticus* sp.: a-f, ♂: a, lateral view of the first and second claspers; b, detail of the tip of second clasper; c, detail of the tip of fifth endite; d, detail of the tip of sixth endite; e, detail of spines of the spiny plateau of fifth endite (= thumb); f, apical view of the first and second claspers. g-h, ♀: g, part of a clutch attached on abdominal legs; h, one egg coated with mucus.

of the six last segments and of upper part of telson with spines and forked hair filaments; g, detail of distal part of furcal claw showing the short spines on their inner side; h, lateral view of the second clasper; i, lateral view of the first two thoracopods, the claspers.

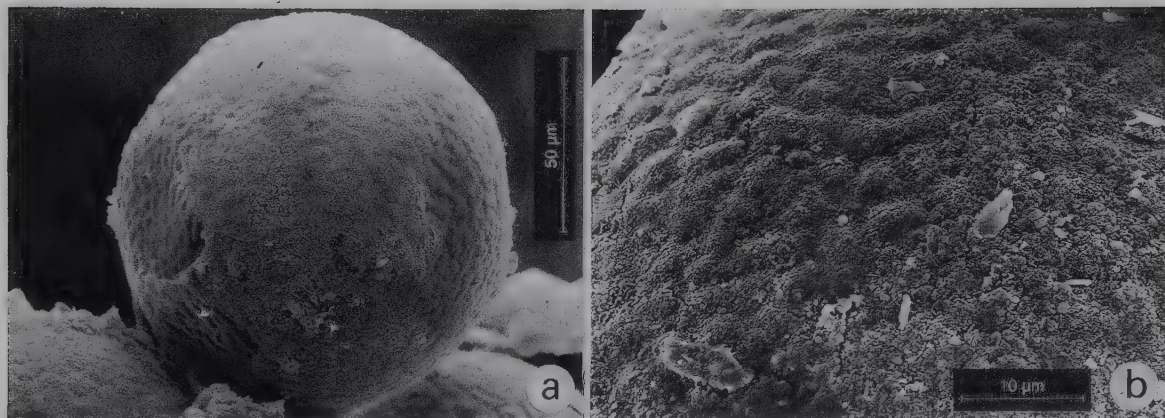


Fig. 25: *Eocyclus* sp. from Qaba: a, whole egg; b, detail of the surface ornamentation showing its bumpy aspect.

necessary. However, the present species shows similarities with species belonging to the group of *E. orientalis*, *E. zugmayeri*, *E. irritans*, *E. klunzingeri*, *E. latirostris*, *E. saharicus*, whose area of distribution extends from China and southern India to western Africa through eremic zones such as the Sahara, Egypt and Sudan. The specimens from Saudi Arabia and Oman also resemble, in certain features, Indian species such as *Eocyclus plumosus* described by ROYAN & SUMITRA (1973). *Eocyclus orientalis* has also been reported from Palestine (HARTLAND-ROWE 1967) and *E. lofti* (Baird) has been found in association with *Leptestheria dahalacensis* in Iraq near Baghdad (DADAY 1914).

Family Leptestheriidae Daday, 1923

Leptestheria mayeti Simon, 1885 (Figs 27-30, 37)

Material: Saudi Arabia: 2 ♂♂, valve length 7.0 mm, one used in SEM study, 2 ♀♀ (one ovigerous), 6.3 mm, 150 km SSW of Riyadh, 13.VI.1959, E. Aichl; 2 ♂♂, 6.7 mm, 1 ♀, ovigerous, 6.8 mm, Wadi Tima, 26.IV.1985, W. Büttiker; 5 ♂♂, 17 growth lines, 7.1-7.8 mm, 1 ♀, ovigerous, with more than 180 cysts (cyst diameter 187-200 µm), 14 growth lines, 5.7 mm, 60 km SE of Jebel Said, 13.XI.1986, W. Büttiker. — Yemen: 1 ♂, 29 growth lines, 7.7 mm, Rabat Alshoba, 23.VI.1990, H.J. Dumont. — Oman: 2 ♂♂, 7-10 growth lines, 4.1 mm, 4 ♀♀, 10-11 growth lines, 4.6-6.1 mm, Haylat Yalooni, 25.III.1995, M. Laurence.

Description: See STRASKRABA (1966). A slightly curved spine on the head rostrum present in males and females (Figs 28 g-h, 30 a); the valves are strongly reticulated (Figs 28 c-e). The ratio of length to height is 1.84-2.22 for males and slightly smaller for females (1.80-1.82), which closely resembles the ratio in Moroccan *L. mayeti* (THIÉRY 1987: Fig. 120). The cysts are spherical, with a smooth shell (Figs 30 e-f, 37 d) and closely resemble those of the North African *Leptestheria* (diameter 170-195 µm; THIÉRY 1987: Fig. 198 e). However, in the population south of Riyadh, the cysts are smaller (mean diameter 137.8 ± 3.4 µm, range 135-145 µm, $n = 8$). By this character, they most resemble the cysts of *Leptestheria dahalacensis* from the northern Mediterranean basin (Thiéry, original data), from Italy (110 µm; TOMMASINI & SCANABISSI SABELLI 1989), and largely from Europe (THIÉRY et al. 1995).

Distribution: *Leptestheria mayeti* is a North African and Saharan species. It has been found in Cyrenaica, Libya (= *L. lybica* Colosi, 1920), and in Jebel Uweinat, an isolated mountain in the north-eastern desert at a point where Egypt, Libya and Sudan meet (MONOD 1974, DE RIDDER et

al. 1988). This species was described in these works respectively under the names of *Leptestheria cortieri* Daday and *Leptestheria dahalacensis* (Rüppel, 1837). In the first case, it is a synonymy, and in the second, after the examination of the specimens at the State University of Gent, Belgium, I confirm that it was a misidentification. *Leptestheria mayeti* differs from *L. dahalacensis* by the lack of the dorsal spines on the last body segments (THIÉRY 1987). If *L. dahalacensis* is a Palearctic element, widely distributed in central Europe and extending to eastern Asia, where the species has

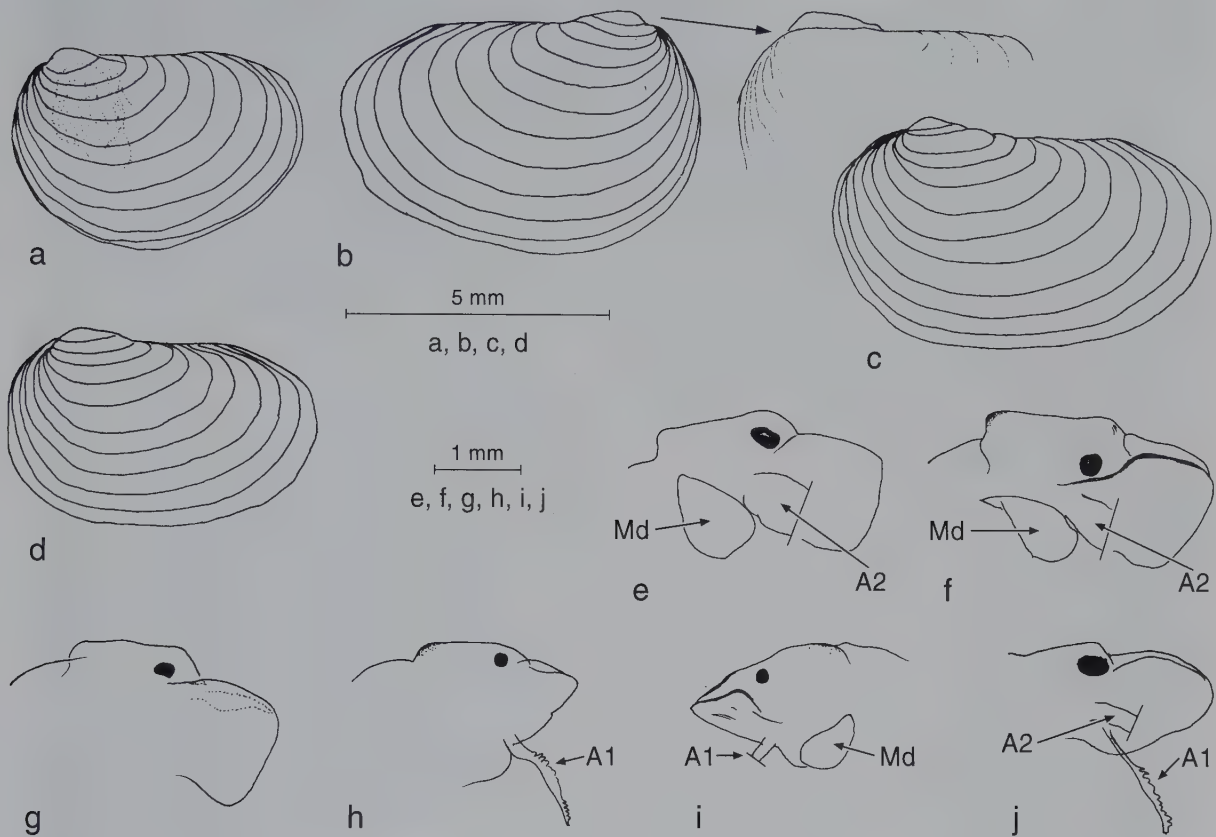


Fig. 26: *Eocyclus* sp.: a-d, shell: a-b, left and right lateral views of ♀ from 150 km SSW of Riyadh and from Shaqq (note the inner view of the hinge region in b); c-d, left lateral views of ♂♂ from Shaqq. e-j, head: e, ♂ from 150 km SSW of Riyadh; f, ♂ from Wadi Rimah; g, ♂ from Shaqq with a spatulate rostrum; h-i, ♀ from 150 km SSW of Riyadh; j, ♀ from Shaqq; rostrum of ♀♀ more rounded than in ♂. Md = mandible, A1 = first antenna, A2 = second antenna.

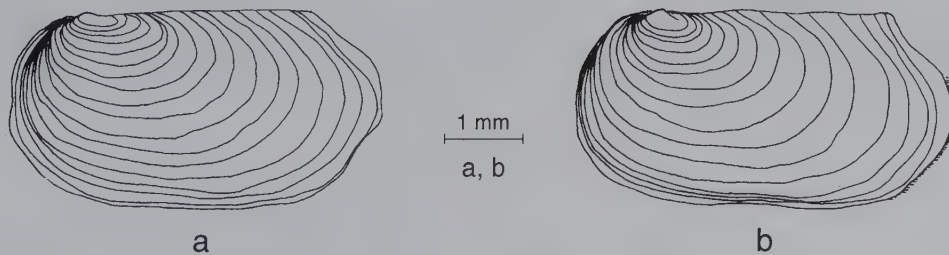


Fig. 27: *Leptestheria mayeti* from Saudi Arabia: a, left lateral view of shell, ♂ from Wadi Tima; b, same, ♂ from 150 km SSW of Riyadh.

been reported from Baghdad (DADAY 1923), *L. mayeti* may be considered as a North African element.

Family Limnadiidae Burmeister, 1843

* *Eulimnadia margaretae* Bond, 1934

Description: See BOND (1934: Fig. 17). Female only known but no data are available on their cysts. The ratio of valve length to valve height is 1.41 and the number of growth lines is three for a length of 10.4 mm (Fig. 33).

Distribution: Species inhabiting freshwater in Aden, without any precision on the biotope.

Eulimnadia sp. (aff. *margaretae*) (Figs 31-37)

Material: Oman: 7 ♀♀, dried out, Mintirib, 28.II.1986, W. Büttiker; more than 80 mature ♀♀ (some ovigerous) and immature specimens, four specimens used for SEM study, Mintirib, 1.III.1986, W. Büttiker; 25 ♀♀ in poor condition, apparently having completely dried out at some time in the past (one non-ovigerous ♀ with a 4.4 mm carapace), cysts used for SEM study, Hamad, 4.III.1986, W. Büttiker; 8 ♂♂, one used for SEM study, and more than 120 immature and mature ♀♀, some of them ovigerous, Sayq, 22.III.1986, W. Büttiker; 16 ♀♀, all ovigerous but with most of cysts matted together and mixed in the vial, mean cyst diameter $188.3 \pm 9.9 \mu\text{m}$, $n = 15$, near Sib Airport, 9.V.1989, M.D. Gallagher.

Remarks: Measurements of specimens are given in Table 5.

Description: As pointed out by STRASKRABA (1965 a), the genus is not sufficiently delimited and the validity of differential characters has been treated very differently in the descriptions of the nineteenth and early twentieth century. More recently, several authors (RADHAKRISHNA & DURGA PRASAD 1975, BELK 1989, MARTIN & BELK 1989 and BRENDONCK et al. 1990) underlined that many traditionally employed characters in species determination prove to be variable and unreliable, moreover not enough attention has been paid to intraspecific variation. As many characters within the genus *Eulimnadia* are misleadingly variable and many species are poorly described, we will present here a description of the female, male and cyst of specimens from Oman as a contribution to the taxonomic knowledge of *Eulimnadia*. In order to facilitate future comparisons, we tabulate some data on the size of males and females (Table 5).

Table 5: Measurements (in mm) of *Eulimnadia* sp. (aff. *margaretae*) specimens from Oman compared to *E. margaretae* from Aden (BOND 1934)

| Location and date | Sex | n | Valve length (= L) | | Valve height (= H) | | Ratio L/H | Number of growth lines |
|---------------------------------------------------|-----|----|--------------------|-----------------|--------------------|-----------------|-----------|------------------------|
| | | | Range | Mean \pm SD | Range | Mean \pm SD | | |
| <i>Eulimnadia margaretae</i> from Aden, 7.12.1932 | ♀ | — | 10.4 | — | 7.4 | 7.4 | 1.41 | 3 |
| Mintirib, 1.03.1986 | ♂ | 15 | 3.86-5.98 | 4.74 ± 0.66 | 2.26-4.25 | 3.10 ± 0.59 | 1.34-1.76 | 1-3 |
| Hamad, 4.03.1986 | ♂ | 1 | 4.39 | — | 2.79 | — | 1.57 | 2 |
| Sayq, 22.03.1986 | ♀ | 11 | 2.53-5.45 | 4.16 ± 1.02 | 1.59-3.32 | 2.68 ± 0.63 | 1.40-1.71 | 0-2 |
| | ♂ | 4 | 4.12-4.65 | 4.42 ± 0.23 | 2.66-2.92 | 2.79 ± 0.15 | 1.55-1.65 | 1 |
| Near Sib Airport, 9.05.1989 | ♀ | 16 | 6.16-7.94 | 7.38 ± 0.42 | 4.11-5.20 | 4.94 ± 0.27 | 1.44-1.56 | 4-6 |

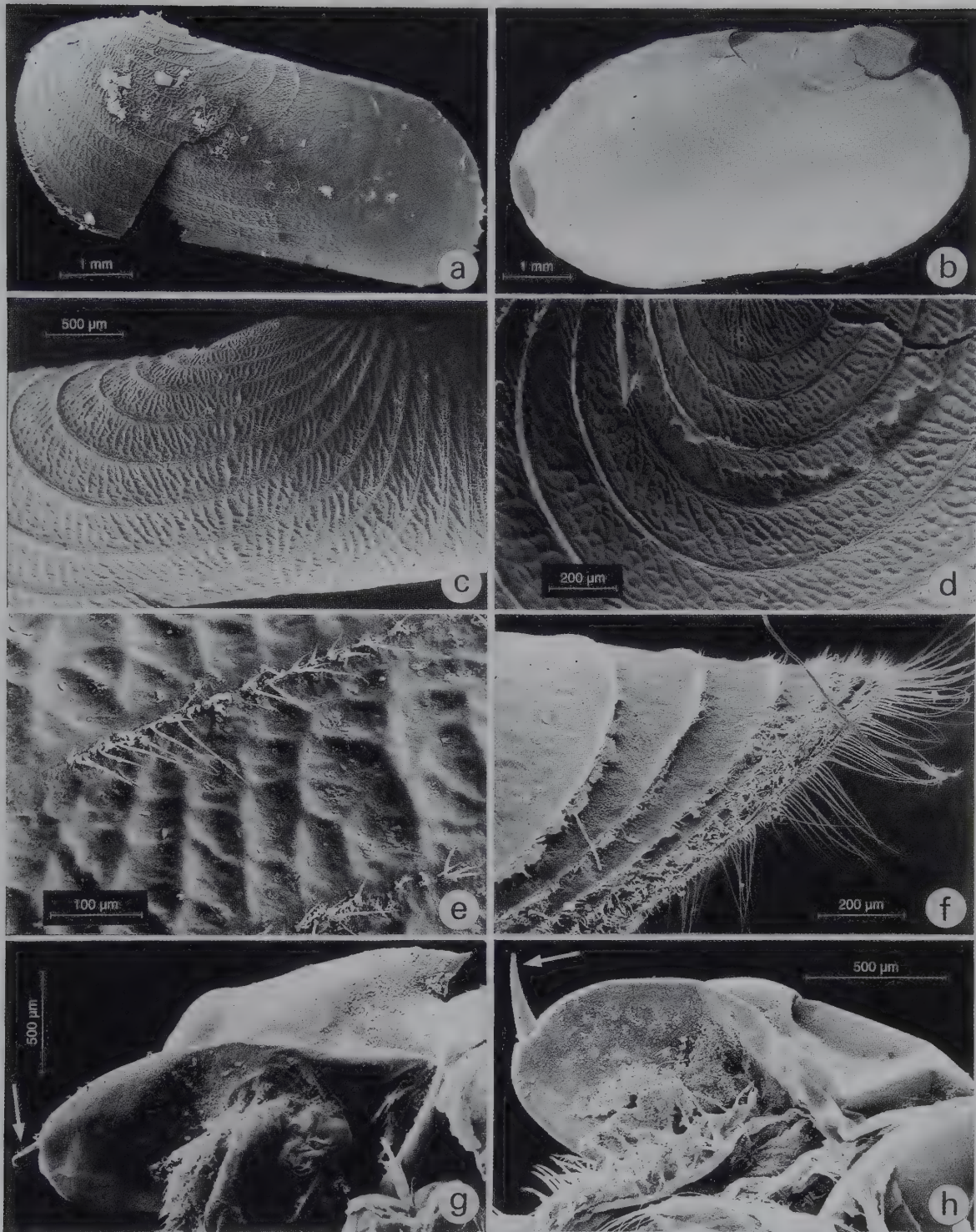


Fig. 28: *Leptestheria mayeti* from Saudi Arabia: a, left lateral view of ♂ valve; b, right lateral view of ♀ valve; c, detail of growth lines and surface reticulation on ♂ valve; d, same, near the umbo; e, same, with some setae on growth lines; f, same, on the last growth lines; g, left lateral view of ♂ head, with rostral spine (arrow) and acute neck; h, left lateral view of ♀ head.

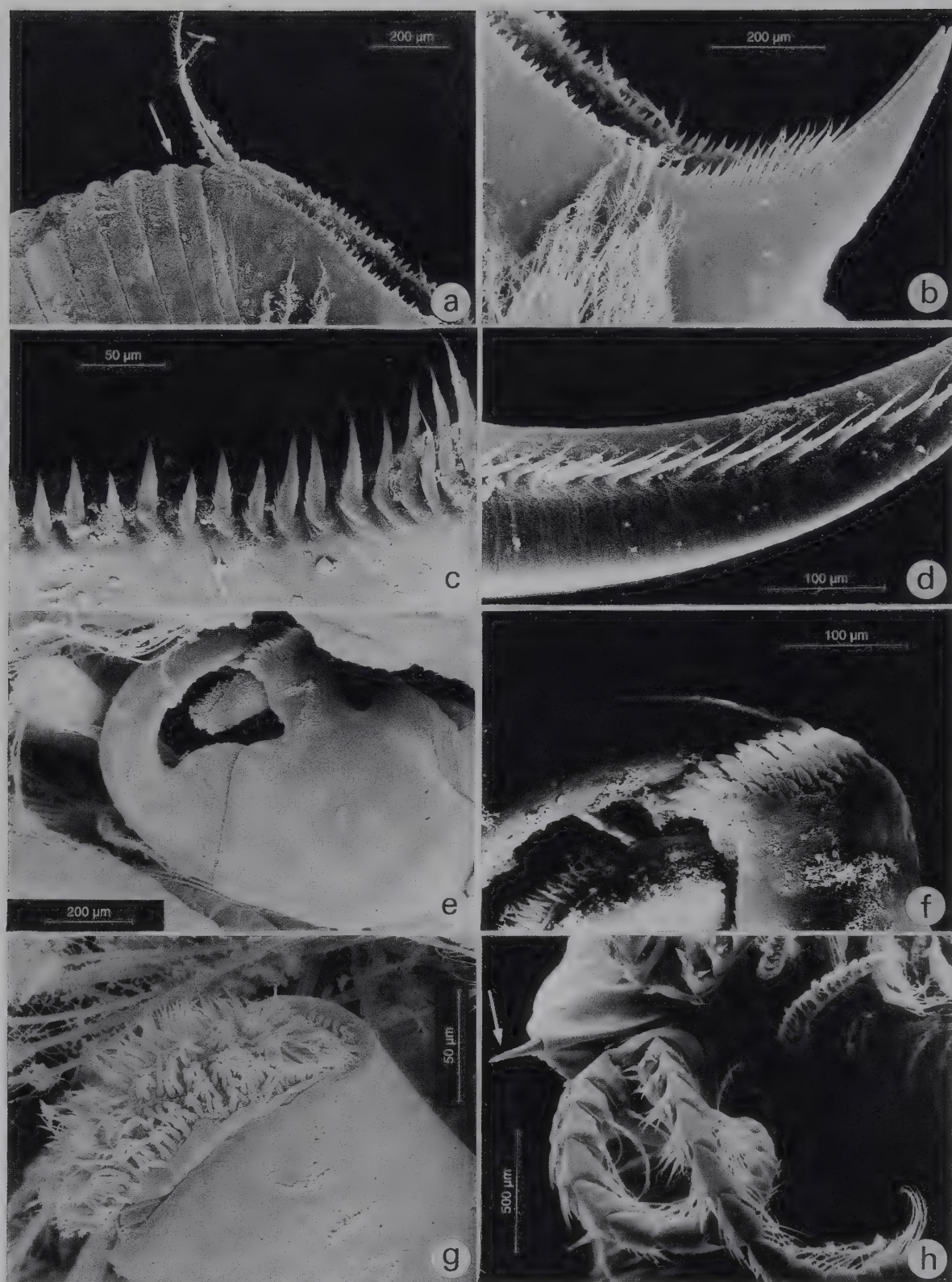


Fig. 29: *Leptestheria mayeti*: a, left lateral view of end of abdomen and telson, the arrow indicates the smooth last segments; b, detail of terminal spine of telson; c, detail of spines on telson; d, detail of spines on inner side of cercopods; e, clasper of ♂ (P1), external view; f, detail of the tip of clasper (endites 4 and 5); g, distal part of palp (endite 6); h, left latero-ventral view of ♀ head with first and second antennae, note the rostral spine (arrow), a character of the family Leptestheriidae.

Carapace: Female carapace (Figs 31 a-b, 35 c-f, 36 a, e) compressed, thin, pellucid, oval (Figs 31 a, 36 a, e), with hinge border domed. Surface smooth with 3-5 inconspicuous growth lines (Figs 31 a, 36 a). The relationship between the number of growth lines and the valve length (in mm) is shown in Fig. 33. The ratio of length to height varies between 1.34 and 1.76. Male carapace with a more straight hinge border (Figs 35 a-b) and with 1-3 growth lines.

From the ratio of length to height, this species is close to *E. margaretae*; however, as the number of growth lines is linked to the length of the valves (see THIÉRY 1987: 197), the very low number of growth lines (three) in the large specimens (10.4 mm) from Aden is a problem. Additional samples from Aden are needed to decide if the specimens from Oman and Aden belong to the same species.

Head: female with rounded rostrum in lateral view while the head of the male is more acute (Fig. 35 h), both with the pyriform frontal organ characteristic for the family Limnadiidae (Figs 35 g-h, 36 b).

First antennae: uniramous, longer in male than in female, both pseudosegmented with groups of aesthetascs on anterior border of each of the 6-8 more or less distinct lobes (Fig. 35 i).

Second antennae: biramous, natatory, same in both sexes, with both rami eight-segmented, of about equal length, each segment with three (or two or one at the tip) distinct spines on dorsal border and plumose setae on ventral border.

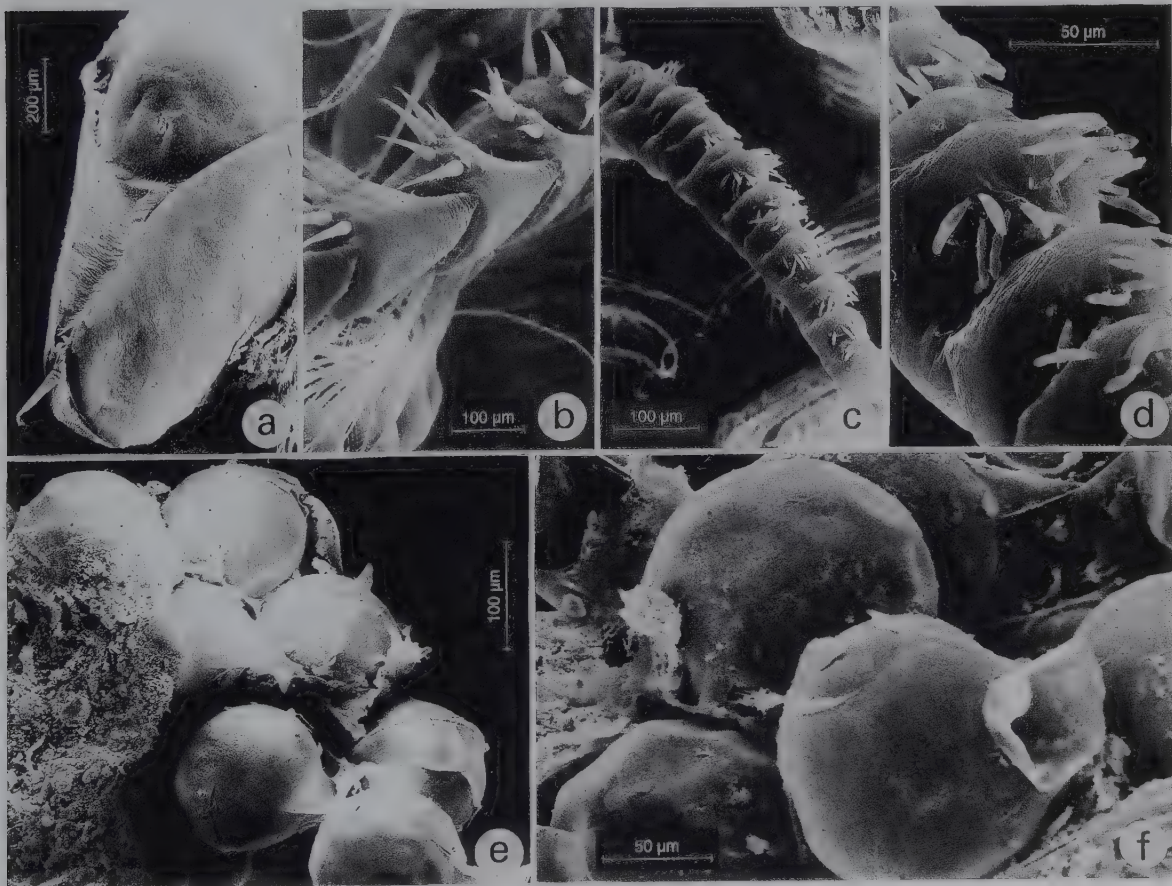


Fig. 30: *Leptestheria mayeti*: a, frontal view of ♀ head with rostral spine; b, detail of spines on dorsal side of segments of second antenna; c, lateral view of first antenna; d, detail of sensory setae on first antenna; e, cysts in a clutch; f, two cysts with a thin mucus envelope.

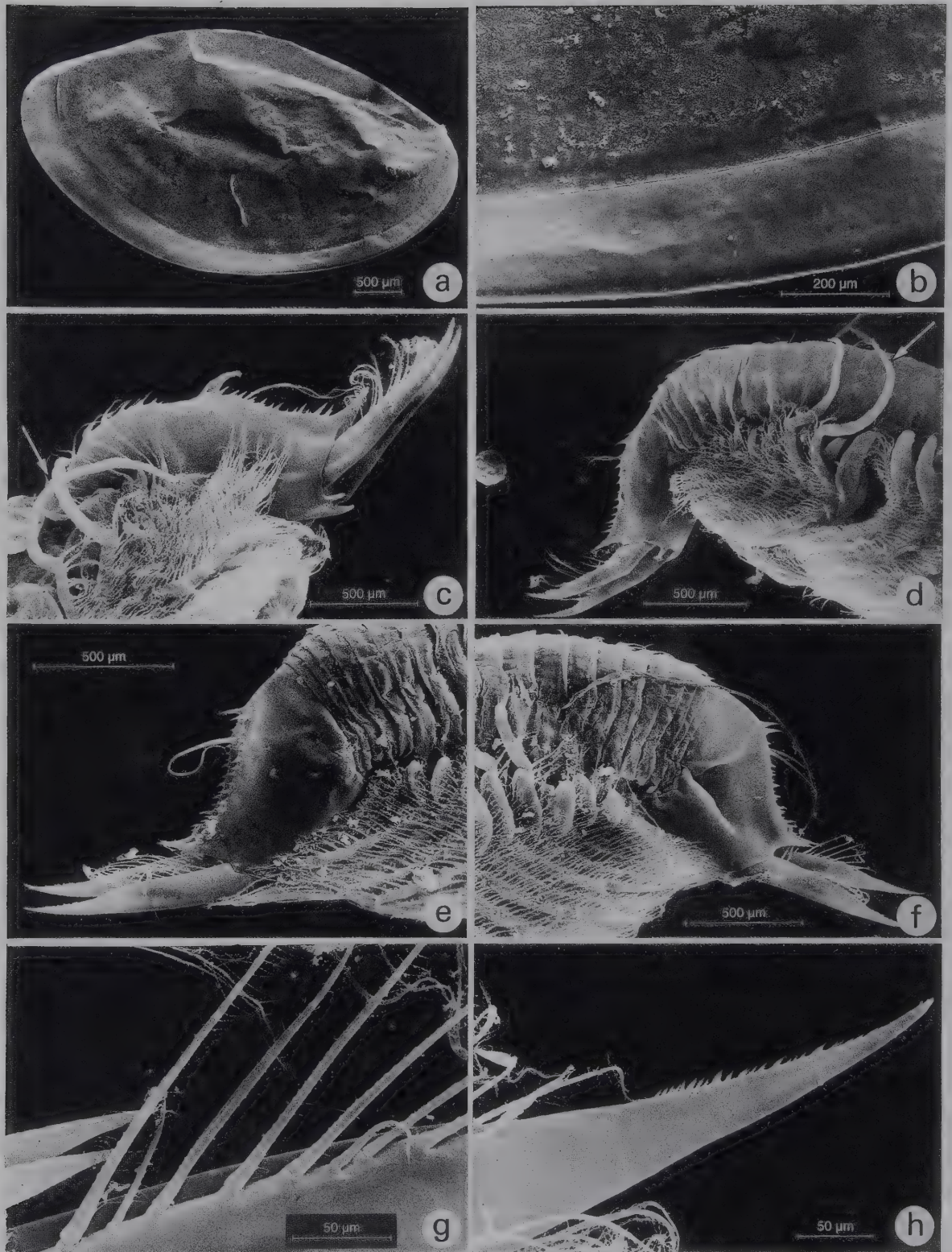


Fig. 31: *Eulimnadia* sp., mature ♀ from Mintirib: a, right lateral view of valve; b, detail of growth line and surface reticulation of the valve; c-f, variability of telson morphology: c, left lateral view of end of abdomen with the ovigerous epipodites of 10th and 11th legs and telson; d, same in right lateral view with a mature cyst; e, right lateral view of telson; f, same from another ♀; g, proximal portion of cercopod showing the thin setules on setae; h, distal portion of cercopod with a row of short spines.



Fig. 32: *Eulimnadia* sp., ♂ from Sayq, Oman: a, right lateral view of a naked specimen, valves removed; b, tip of clasper with long spines on endite 4 (arrow) and the typical sucker on endite 5 (arrow); c, first and second legs, left, of ♂ modified into claspers, a part of the first right clasper is visible; d, same in another view; e, detail of the tip of second clasper in lateral view; f, detail of the distal sucker on endite 5; g, detail of the distal part of the palp of second clasper, note the long setae reaching the tip of the palp (arrow); h, lateral view of the sucker; i, tip of clasper in another view.

Thoracopods: 17 (or 18) pairs exhibiting usual structure; in male, first and second pairs are modified into claspers (Figs 32 b-e, i). In the second clasper, the 6th endite (palp) is longer than in first clasper (Figs 32 c-d), with seven or eight long setae inserted at the base of the second segment and reaching its tip (Fig. 32 g). Suction disc at the tip of finger (exopodite) of each clasper (Figs 32 b, e-f, h-i) and numerous flat and rounded teeth on their inner border (Figs 32 b-e, i); numerous short and acute teeth on the apical part of the endopodite, with 4-7 longer teeth on its inner border (Figs 32 b-e). In mature females, the 9th and 10th pairs of legs with dorsal lobe of exopodite modified into long and curved flabellum allowing cyst attachment (Figs 31 c-d).

Dorsal armature: 8-11 body segments bearing dorsolateral hooks and spines (Figs 31 c-f, 36 b-d), approximately arranged (from frontal to caudal) as follows: 0 or 1, 3, 3, 3, 3, 5, 5, 5, 3, 2 or 1, 2 or 1.

Telson: similar in male and female (Figs 31 c-f, 36 c-d); two rows of 10-12 small spines on dorsal edge and two stronger spines, anterior and posterior ones. Telsonal filaments inserted between second and third pairs of spines. Ventral spine slightly curved upward and rounded to its apex. Cercopods as long as telson, each with a row of 14-16 slender setae on first two-thirds (Fig. 31 g) and small spines on the last posterior third (Fig. 31 h). A larger and downward curved spine arises near the last slender setae.

Cysts spherical with crater-like depressions and surface textured with numerous minute pores (Figs 34, 37 f). Mean cyst diameter $186.6 \pm 10.5 \mu\text{m}$, range 166-206 μm , $n = 39$. As shown by BELK (1989), MARTIN (1989), MARTIN & BELK (1989) and BRENDONCK et al. (1990), the shell morphology of the cyst is of great interest in the taxonomy of the genus *Eulimnadia* and often exhibits species-specificity. The cysts of species from Oman closely resemble those of *Eulimnadia michaeli* Nayar & Nair, an Indian species. However, deep depressions are more numerous in the former.

Distribution: Widely distributed in Oman in freshwater and in slightly salty water.

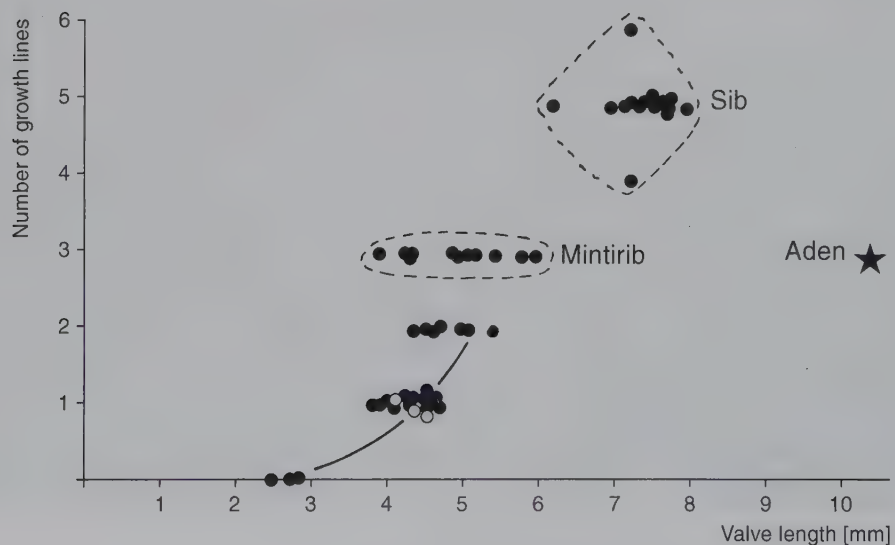


Fig. 33: Relationship between number of growth lines and valve length in *Eulimnadia* ♀♀ (closed circles) and ♂♂ (open circles) from Oman (samples from Hamad, Sayq, Mintirib and Sib airport). The black asterisk refers to *Eulimnadia margaretae* in BOND (1934).

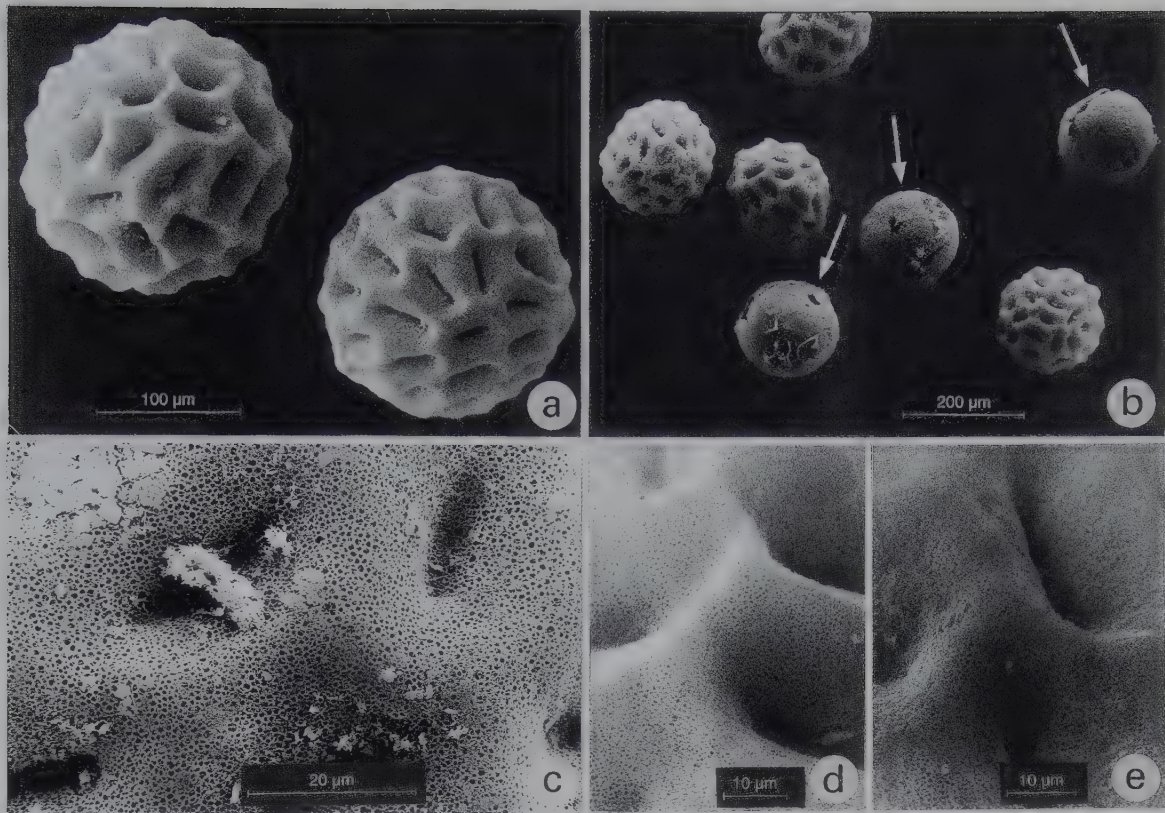


Fig. 34: *Eulimnadia* sp. from Hamad, Oman: a, view of two cysts; b, comparison of cyst diameter and external cyst morphology between *Eulimnadia* and *Cyzicus gihoni* (arrows); c, detail of the cyst surface showing the pores; d-e, two different aspects of the surface.

Order Laevicaudata Linder, 1945

Family Lynceidae Sayce, 1902

* *Lynceus semiaefacies* Harding, 1941

Description: See HARDING (1941: Figs 1-12).

Distribution: Males and females were reported from a temporary pool in Jebel Jihaf (2164 m), Western Aden Protectorate, in September 1937; species co-occurring with *Streptocephalus neumanni*. Not found in Saudi Arabia or in Oman. To date, the species is considered endemic to south-west Arabia. As for the anostracan species *Streptocephalus neumanni*, its range seems to extend from the Oriental region to east and central Africa where *Lynceus* species are numerous (MARTIN & BELK 1988). Cysts remain unknown.

DISCUSSION

More than 1000 specimens were collected from 63 biotopes distributed over almost all the ecological regions of Arabia (Figs 1-4) and Syria. Two regions that were not surveyed include the Rub al-Khali or the "Empty Quarter" of the Saudi Arabian desert and the United Arab Emirates. Nearly all samples were collected during early spring (March, April, May) corresponding to the

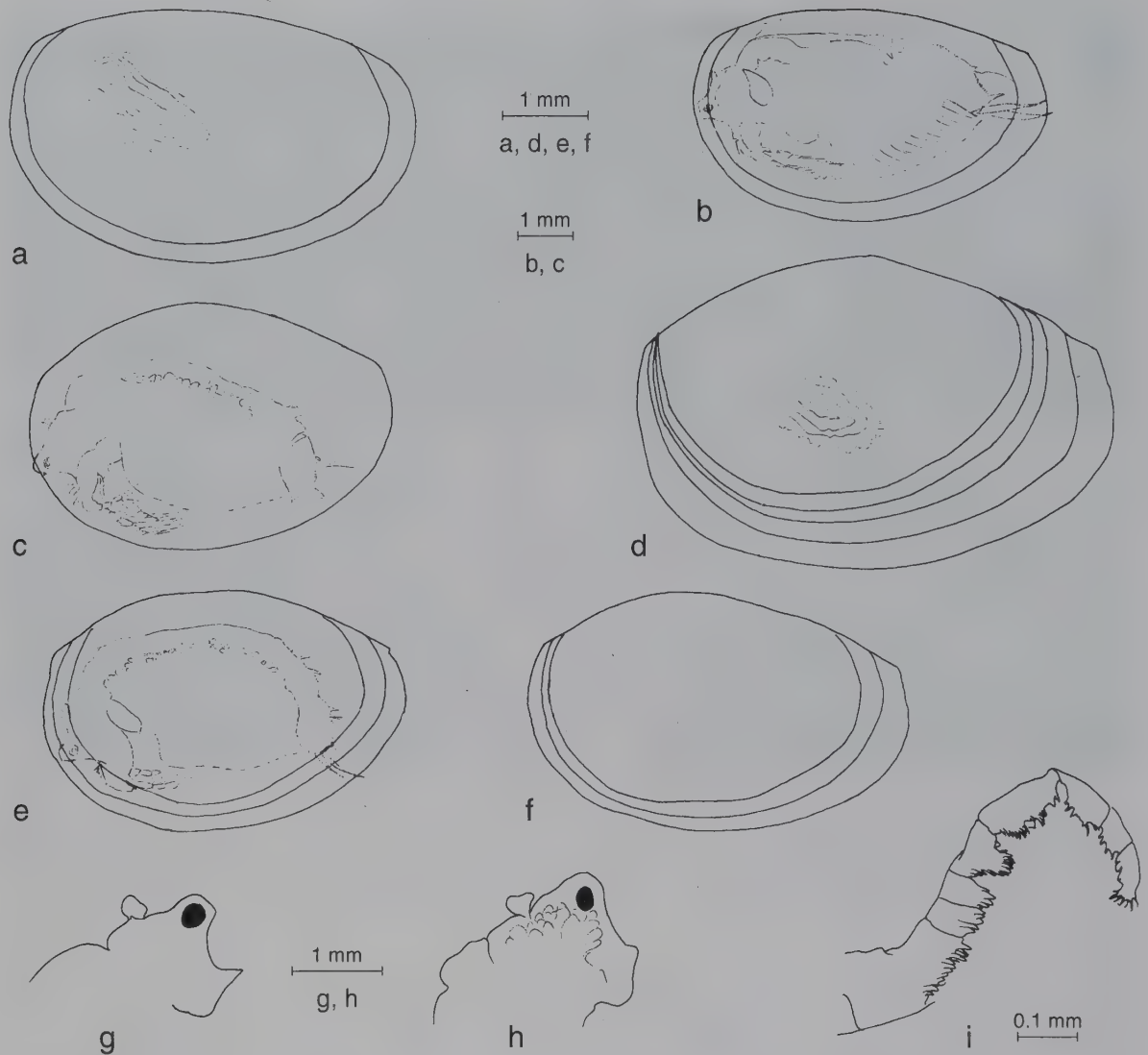
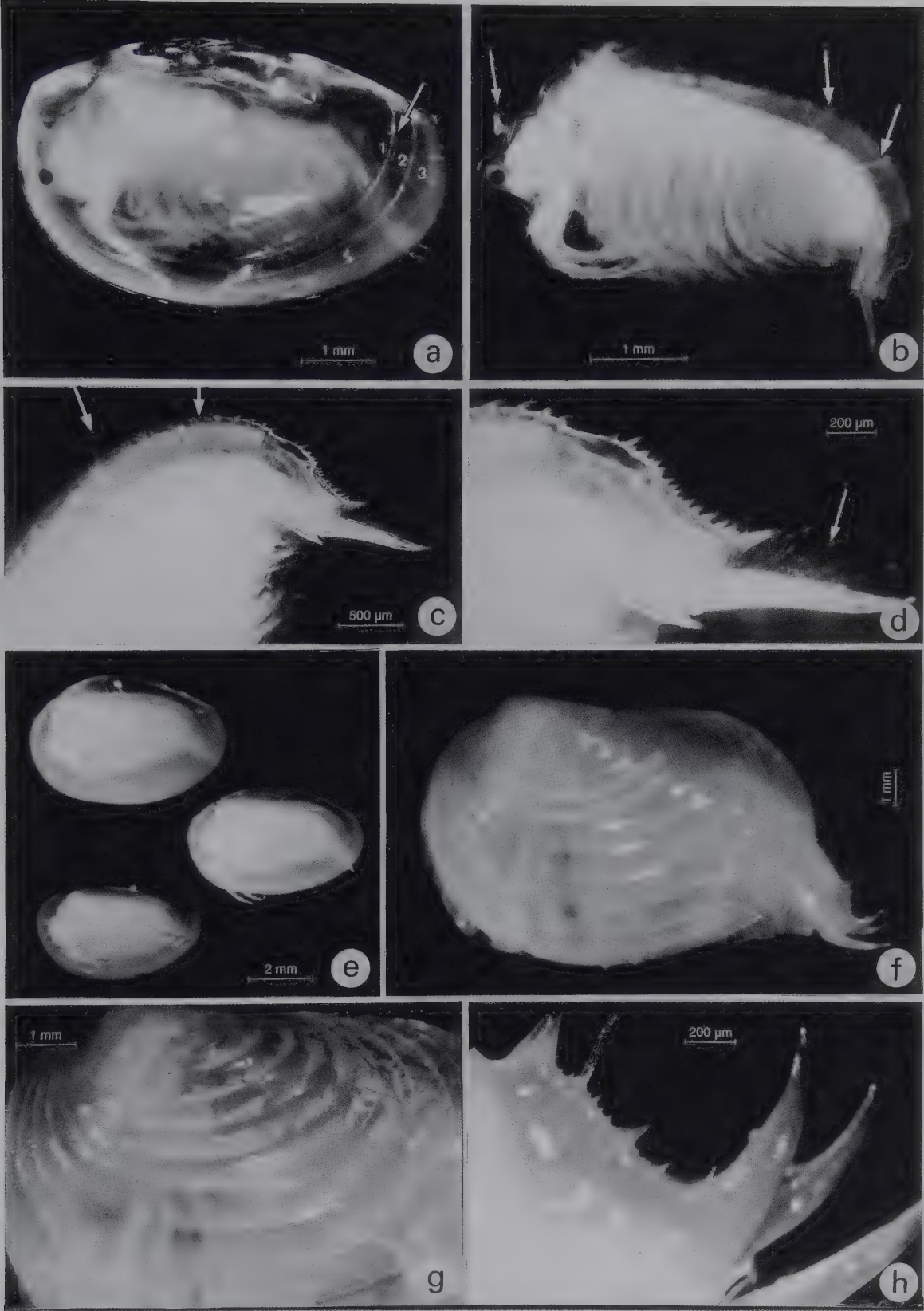


Fig. 35: *Eulimnadia* sp. from Oman, shell: a-b, left lateral view of ♂♂ from Shaqq; c-f, left lateral view of ♀♀; g-h, right lateral view of head: g, ♂; h, ♀; i, first antenna of ♂ from Sayq.

flooding of pools after the most rainy months in Arabia (December to February) and only two samples were collected during November following a second short rainy season in October (see SIRAJ 1984). It shows that the occurrence of “large branchiopod” populations is dependent on the climatic features, principally the precipitation regime.

Fig. 36: External morphology of ♀♀ (stereoscope photos): a-e, *Eulimnadia* sp. (aff. *margaretæ*): a, left lateral view of the thin and pellucid shell showing three growth lines (arrows); b, left lateral view of an immature ♀ removed from its shell showing the pyriform organ (arrow) and the two translucent flabella (arrows); c, left lateral view of end of abdomen and telson with the two translucent flabella of another immature ♀ (arrows); d, detail of telson in left lateral view showing the hairy proximal part of cercopods (arrow); e, variability in the morphology of the shell (the three ♀♀ do not have the same age). f-h, *Cyzicus gihoni*: f, left lateral view of shell with numerous growth lines; g, detail of shell with 11 growth lines; h, left lateral view of telson showing the unequal dorsal spines.



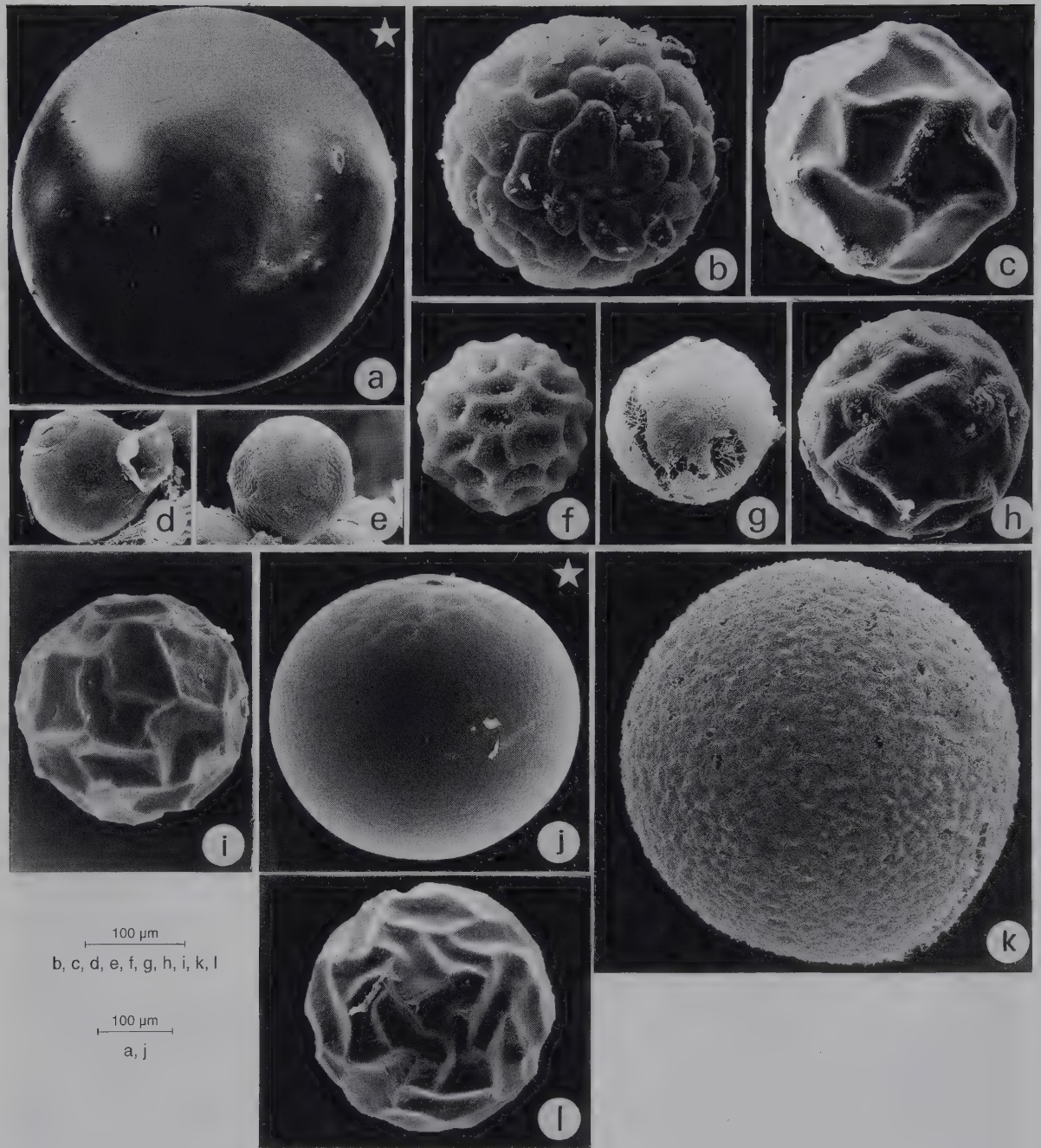


Fig. 37: Comparison of external morphology and diameter of the cysts found in the Arabian Peninsula (except *Artemia*, *Chirocephalus neumanni* and *Triops numidicus*): a, *Lepidurus couesii*; b, *Streptocephalus* sp.; c, *Branchipus schaefferi*; d, *Leptestheria mayeti*; e, *Eocycticus* sp.; f, *Eulimnadia* aff. *margaretæ*; g, *Cyzicus giboni*; h, *Branchinella spinosa*; i, *Streptocephalus torvicornis*; j, *Triops cancriformis simplex*; k, *Tanymastigites cyrenaica*; l, *Branchipodopsis* n. sp. All cysts of Anostraca and Spinicaudata are presented at the same scale while those of Notostraca, marked with a white star, are shown at a different scale. The cyst of *Triops numidicus* closely resembles that of *Triops cancriformis* but is too big (500-650 µm) to be presented here at the same scale. The cysts of *Streptocephalus simplex* are not shown here, but described in the text; those of *Lynceus semiaefacies* are unknown.

The branchiopods sampled are grouped into ten families: five in Anostraca, one in Notostraca, two in Spinicaudata and one in Laevicaudata. The nineteen identified species belong to seven genera in Anostraca, two genera in Notostraca, four genera in Spinicaudata and one genus in Laevicaudata. This fauna is just as rich as those of several other well-known regions (see GAUTHIER 1928 a, THIÉRY 1987, for the Maghreb, and BELK & ESPARZA 1995, for the Indian subcontinent). This diversity results from a great diversity of ecological conditions over the peninsula (climates from hyperarid in deserts to humid in the Yemeni mountains; pools of both freshwater and of varying salinity in Oman). This diversity might also be linked with the chemical characteristics of the water as in Morocco (see THIÉRY 1987, THIÉRY & GARCIN 1986) but no data are available to build any hypotheses. Several species appear to be dominant in terms of the number of collected specimens and in the number of colonised pools such as *Triops numidicus* (194 individuals at 21 stations) and *Eocyclus* (141 individuals at 16 stations). The richer zones (Fig. 4) are the deserts (e.g. Nejd, NE Dhofar), where temporary biotopes are numerous while in mountain and foothill areas (Asir, Yemen and Oman) they are less numerous. The richer communities are found in Nejd with five co-occurring species in one pool and in northeastern Dhofar with four co-occurring species. In most of the other zones the temporary pools have no more than two or rarely three co-occurring species. For a review of the biological, ecological and climatic factors allowing for the multispecies coexistence of branchiopods in a temporary pond see THIÉRY (1991), and HAMER & APPLETON (1991 a, b). From this material one new species has been discovered from Oman (*Branchipodopsis* n. sp.) making, for the first time, the link between the African and the Asian representatives of this large genus. The taxonomic study of the Arabian "large branchiopods" shows that though some species are well defined, such as *Triops numidicus*, *Branchipus schaefferi*, *Branchinella spinosa*, and *Leptestheria mayeti*, some others need a more complete description (*Streptocephalus* sp., *Lepidurus couesii*) and sometimes, as in the case of the spinicaudatan Cyzicidae and Limnadiidae, a revision within the genera. This systematic study also confirms that, for the studied fauna, the cyst morphology paired with its diameter is a useful species- or genus-specific character, as shown by numerous previous authors (GILCHRIST 1978; MUNUSWAMY & SUBRAMONIAM 1983; ALONSO & ALCARAZ 1984; MUNUSWAMY et al. 1985; SAMYIAH et al. 1985; MURA 1986, 1991; MURA & THIÉRY 1986; THIÉRY & CHAMPEAU 1988; BELK 1989; MARTIN & BELK 1989; BRENDONCK et al. 1990, DE WALSCHE et al. 1991, THIÉRY & GASC 1991, BRENDONCK et al. 1992, THIÉRY et al. 1995). In this respect the present material confirms the hairy structure of cysts of *Cyzicus* and the bumpy shape of *Eocyclus* to be generic characters. It also confirms the low variability of the cyst morphology of a species within a large area of its distribution, such as in *Branchipus schaefferi*, *Branchinella spinosa*, *Lepidurus couesii*, *Triops numidicus* and *Triops cancriformis simplex*. The cyst pattern has also been shown to be a good tool for distinguishing different closely related species such as in *Streptocephalus* where, for example, the classic characters such as the antenna of the male were useless in providing a clear distinction, or to separate without ambiguity the genus *Cyzicus* from *Eocyclus*. Cysts now allow the occurrence of a species to be proven even if the adults were not found, such as in the case of *Chirocephalus neumanni* from a pond in the west of Syria. This recent method of taxonomic investigation, followed now for a decade, might be of major interest in future genus or family reviews. From the present study comparisons can easily be made with Fig. 37, where most of the cysts are illustrated at the same scale.

With respect to its biogeographic range this aquatic fauna is a mixture of species and lineages having European, southern Asian or African ties. The European lineage is dominant in Syria and the north of the Peninsula. The African elements are widely distributed in the greater part of Saudi Arabia, in arid and desert areas (Nejd, Hijaz), while in the mountains in the western border (Asir),

the "large branchiopod" fauna bears common features with mountain fauna of Morocco, Algeria and Libya. The elements which have south Asian ties are concentrated in the south of the Arabian Peninsula, principally in Yemen and Oman (Hadramaut, Dhofar, Oman).

The actual composition results from the geographic situation of the Arabian Peninsula which is strategically at the junction of three major regions: the Mediterranean basin (Palaeoartic influence), Africa and Asia. The different ranges of species result from two main factors: the palaeogeographical evolution of the western Asian area and climate, past or present, to favour the development of this fauna.

Palaeogeography

The palaeogeographical history is of great interest in the distribution of continental aquatic fauna (BANARESCU 1992). We can separate several major events as:

- a) broad continental contacts of the Arabian Peninsula with Africa from Triassic to Neogene times: the Arabian-Nubian Shield (BENTON 1985, STÖESER & CAMP 1985) and detritic sedimental deposits in Ethiopia-Arabia-Yemen during the Permo-Trias (BEAUCHAMP 1978)
- b) exundation of the Near East / Iraq / Iran in the early Miocene with definitive continental contacts with western Asia
- c) separation of the Arabian Peninsula from Africa in the middle/late Miocene.

For a detailed and wonderfully illustrated study on evolution, the palaeoenvironment of Tethys and particularly Africa vs. Arabia from Permian (Late Murgabian 266-264 MA) to Miocene (Tortonian 11.5-6 MA) see DERCOURT et al. (1993). A map of the Middle Jurassic non-marine palaeofacies in Arabia with sedimentary settings is given in AL-ASWAD (1995). The western mountains belong to the geological structure of north-eastern Africa, and those of Oman belong to the system of the Iranian mountains. For information on the impacts of the tectonic movements on the biogeography of the northern peninsula (Levant, Syria, Mesopotamian subregion) see POR (1989). From their evolution, the African component of the recent Arabian Peninsula is the oldest, its direct ancestors entered Arabia when it was still a part of the African mainland, having at least a Miocene age (the case for *Tanymastigites cyrenaica*, *Triops numidicus*, and *Leptestheria mayeti*). This might explain the strong affinities with the Maghrebian fauna. This fauna was surveyed in Morocco by THIÉRY (1987), in Algeria and Tunisia by GAUTHIER (1928 a) and in Cyrenaica, Libya by COLOSI (1922) but the fauna of Egypt has received very little attention and is poorly known. These distribution patterns also fit with the distribution of several zooplankton genera studied by DUMONT (1981), particularly with the genus *Metadiaptomus*. In the case for *Streptocephalus torvicornis* and *Streptocephalus* sp., a possible common ancestor widely distributed in North Africa probably evolved on the Arabian Peninsula, giving birth to several sublineages concentrated in the western mountains. This question is discussed in DUMONT et al. (1995).

The comparison of both African and Arabian phytocoenoses, made by MONOD (1957: 91-96) reinforces their strong affinities. In a voluminous paper this author particularly noted the Sahelian affinities of the Hadramaut, and Dhofar, as of the central Arabia and Empty Quarter. The Indo-Asian affinities are also signalled in the southern peninsula.

Climate

During the Neogene, and up till post-glacial times, a warm or hot climate with increasing aridity in the area has certainly favoured the occurrence of temporary waters and so favoured the African and Asian species (for a review see BÜTTIKER & LEWIS 1983). To the contrary this climate has not

favoured the penetration of the European lineages, further than Syria/Iraq. DUMONT (1982) gave a further interpretation of the patterns of distribution in terms of climatic fluctuations since the late Würm in Africa and he shows in his Fig. 13, p. 19, the estimated faunal movements in Africa and Arabia before 20,000 BP and around 18,000 BP.

The present climate, particularly annual rainfall and temperature, have a strong influence on the "large branchiopod" distribution (GAUTHIER 1928 a, THIÉRY 1986 a, ROUX & THIÉRY 1988). In North Africa the phyllopod distribution fits with synthetic indices such as thermal and pluvial continentality (THIÉRY & GARCIN 1986). The dominance of the Eremian association *Triops numidicus* – *Leptestheria mayeti* – *Branchipus schaefferi* – *Eocyzicus* sp., over a large part of the peninsula, co-occurring sometimes with *Tanymastigites cyrenaica* or *Streptocephalus* sp. (to the south of Riyadh) indicates that similar climatic factors govern these species. Average annual rainfall throughout Arabia is very low, being 125 mm or less and long spells of drought, which are common in most regions, may be occasionally broken by short but intense rainfall (flash floods). However, exceptions occur in few high-altitude areas in the south-western mountainous region. For more data on the climate of Saudi Arabia see SIRAJ (1984) and GALLAGHER & WOODCOCK (1980). Along the western border, in the Highlands (foothills and Asir) with somewhat more moderate conditions, a streptocephalid is more abundant presenting the same distribution as in Morocco, Algeria and Palestine related to rainy regions. Data on the climate of Oman are incomplete.

All these species inhabit turbid, temporary waters and their ecology and coexistence might be made clear by other factors such as trophic components, as has been shown for Moroccan associations (THIÉRY 1991). In several cases the abiotic characteristics, rather than geographic or climatic factors, might be taken into account to explain the distribution of species. *Branchinella spinosa* and *Eocyzicus* sp. are more frequent in Oman due to the relative abundance of more or less salty waters in Dhofar, Wahiba desert. However, due to the difficulty in identifying the *Eocyzicus* species, little can be said at present about its ecology; *Eocyzicus* sp. seems to be, as *E. saharicus* and some others *Eocyzicus* species, a stenotherm and euryhaline element inhabiting either turbid and slightly salty waters, as is the case in Oman where *Eocyzicus* co-occurs with *Branchinella spinosa*, a strictly salty water anostracan, or turbid and freshwater, as is the case in Oman where *Eocyzicus* has been found with *Leptestheria mayeti*, *Branchipodopsis* n. sp. and *Triops numidicus*. *Artemia* is of little biogeographical interest.

In the southern peninsula, Oriental elements and endemic species occur in Yemen but are rare (*Lynceus semiaefacies*, *Streptocephalus simplex*), while one palaeotropical (Indo-African) species, *Eulimnadia* sp., is more frequent and abundant in Oman. These Indian affinities have also been described in freshwater Ostracoda by DUMONT et al. (1986). Several other cases of southern Asian affinities have also been listed in freshwater insects (BANARESCU 1992).

It appears at last that the branchiopod community structure, its pattern of distribution on the Arabian Peninsula and its great diversity, agrees with BODENHEIMER's (1937) opinion based on terrestrial invertebrates and vertebrates, i.e. domination of Ethiopian and Paneremian elements extending from Morocco-Sahara to arid and desert regions of the peninsula, Oriental and Irano-Turanian elements penetrating into the southern and eastern half of Arabia, with several Mediterranean or Palearctic relics (*Triops cancriformis simplex*, *Streptocephalus torvicornis*) found in the highest parts of the south-western mountains. It also supports some of the results of LEWIS (1974; Phlebotomids) and of SCHNEIDER & KRUPP (1993; dragonflies), such as the penetration of Indo-Asiatic ('Oriental') elements into Oman and the notion of 'refugia' in mountains. As for the Odonata fauna, the south-west (Yemen) and Dhofar-Hadramaut are the regions with endemics

(*Branchipodopsis* n. sp., *Lynceus semiaefacies*, and perhaps *Eulimnadia margaretae*). This study provides some of the new zoological data required to make the adjustments required by ABO-KHATWA et al. (1980) on the zoogeographical map drawn by MATTINGLY & KNIGHT (1956; based on mosquitoes), a map which today seems to be too imprecise in the light of the studies published during the last decade.

As shown above, three main influences could be noted: African elements in Nejd, Hijaz and a small part of Rub al-Khali, a North African influence in Asir and partly in Yemen (mountains), and Indo-Asiatic ('Oriental') elements in Hadramaut, Dhofar and Oman.

The present results might also provide information for a future zoogeographical synthesis on the Arabian freshwaters. However, although the present distribution pattern of Arabian "large branchiopods" fits with palaeogeography and climate evolution, it is to be expected that we shall get a better insight from sampling as many populations from this area as possible in order to better define their status and their distributional patterns. Larger surveys over several poorly known zones such as the Asir, the Rub al-Khali, central Dhofar and Hadramaut are required to complete the present distribution pattern. A study on Socotra Island is also required, this island having several endemic plants of Indo-Asian affinity (MONOD 1957). The distribution of the three species *Streptocephalus simplex*, *S. neumanni*, and *Lynceus semiaefacies* in Yemen (species only known from the literature) also needs to be defined.

In the future it will be very interesting to discuss these patterns in relation to other dispersal factors. Three types can be recognised: a) bird migrations; aquatic birds are known to transport cysts in their digestive tract (see PROCTOR 1964, PROCTOR et al. 1967) and are presumed to be of importance in the colonisation of wetlands such as the Camargue (see THIÉRY & PONT 1987) or islands (see BELK & LINDBERG 1979, BRENDONCK et al. 1990); b) vertebrates which can transport cysts from pool to pool (sheep or camels for example, see THIÉRY 1987, 1991); and c) the east-west circulation of winds, the Indian summer monsoon which reaches the southern peninsula, Oman and the arid zones of Yemen and so might be implicated in dust and hence in cyst transport (see CHAMPEAU & THIÉRY 1990). In the case of *Artemia*, the many introductions have changed the original strains and so no interpretation can be made.

Finally, new research using biochemical techniques such as the isoelectric focusing method useful for measuring the genetic distance between species (see THIÉRY & FUGATE 1994), will be of great significance. It could clarify, for example, the *Streptocephalus* sp., *Triops numidicus*, *Eulimnadia* aff. *margaretae*, and *Eocyzicus* aff. *plumosus* taxonomic problems, and even explain the level of endemics in the mountains of Yemen and in Oman.

ACKNOWLEDGEMENTS

I am grateful to Prof. W. Büttiker (Natural History Museum Basel, Switzerland), Dr. M. Türkay (Forschungsinstitut Senckenberg, Frankfurt, Germany), Mr. M.D. Gallagher (Oman National History Museum, Muscat), Prof. R. Victor (College of Sciences, Sultan Qaboos University, Oman) for the loan of their collections and for comments and suggestions. Grateful appreciation is extended to Prof. H.J. Dumont (State University of Gent, Institute of Animal Ecology, Belgium) for kindly criticising the manuscript. I thank W. Büttiker for initiating this work, for his continuous help and patience, for colour photographs, drawing maps, and for his regular exchange of letters; it has been a great pleasure for me to name the new *Branchipodopsis* species in his honour. The Rn. Dr. J. Brtek (Hornotrianske Muzeum, Prievidza, Slovakia) is sincerely thanked for

confirming the validity of the new *Branchipodopsis* species. I am also indebted to Dr. H. Saïah (University of Lausanne) who provided me with unpublished micrographs of *Streptocephalus rubricaudatus* cysts which were helpful in this study; to Dr. D. Belk (Our Lady of the Lake University, San Antonio, Texas, U.S.A.) who kindly told me of the results of his cave samples in north-eastern Arabia. Special thanks to C. Grill and C. Gasc for assistance with electron microscopy. Finally, I express my appreciation to the Fauna of Saudi Arabia staff for their time and patience, especially to Eva Feltkamp for her assistance with editorial problems and her suggestions on my manuscript, and to C. Martin and Florence, my daughter, for support and understanding.

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Appendix

List of localities in Saudi Arabia, Yemen, Oman and Syria where "large branchiopods" were collected. Places are listed by their numbers in the maps (Figs 1-3). *Streptocephalus simplex* is not included in this list.

A. sp. = *Artemia* sp.; *B. n. sp.* = *Branchiopodopsis* n. sp.; *B.s.* = *Branchinella spinosa*; *B.sch.* = *Branchipus schaefferi*; *C.g.* = *Cyzicus gihoni*; *C.n.* = *Chirocephalus neumanni*; *E.m.* = *Eulimnadia* sp. (aff. *margaretae*); *E.p.* = *Eocyzicus* sp. (aff. *plumosus*); *L.c.* = *Lepidurus couesii*; *L.m.* = *Leptestheria mayeti*; *L.s.* = *Lynceus semiaefacies*; *S. sp.* = *Streptocephalus* sp.; *S.n.* = *Streptocephalus neumanni* (in BMNH); *S.t.* = *Streptocephalus torvicornis*; *T.c.* = *Tanymastigites cyrenaica*; *T.c.s.* = *Triops cancriformis simplex*; *T.n.* = *Triops numidicus*

| No. | Date | Location | Alt. [m] | Coordinates | Collector | Species |
|--------------|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------|-----------|-----------------|------------------------------------------------------|-------------------------------------------------------------------------|
| Saudi Arabia | | | | | | |
| 1 | 13.06.1959 | 150 km SSW of Riyadh; no geographical or ecological information available | ca 560 | 23°25'N 46°10'E | E. Aichl | <i>B.sch.</i> , <i>S. sp.</i> , <i>T.n.</i> , <i>E.p.</i> , <i>L.m.</i> |
| 2 | 27.04.1976 | Wadi Durmah (see BÜTTIKER 1979: Fig. 8); relatively rich vegetation with several oases; irrigation | 580 | 24°35'N 46°10'E | W. Wittmer & W. Büttiker | <i>T.n.</i> |
| 3 | 02.05.1976 | Hieth, 40 km SE of Riyadh (see BÜTTIKER 1979: Fig. 8); few <i>Acacia</i> trees; shrubs and annuals intermingled with sand dunes | 510 | 24°25'N 46°47'E | W. Büttiker | <i>T.n.</i> |
| 4 | May 1979 | Jebel Buwaybiyat, 20 km N | 680 | 25°14'N 46°45'E | W. Büttiker | <i>T.n.</i> |
| 5 | 21-25.01.1984 | Hanakiyah, small temporary pool near flooded river in Arabian shield | 850 | 24°47'N 40°24'E | W. Büttiker | <i>B.sch.</i> , <i>T.n.</i> |
| 6 | 17.04.1984 | Mibhil, pool with very low water level, crustaceans very numerous; no bushes or trees | 800 | 25°20'N 43°17'E | W. Büttiker | <i>B.sch.</i> , <i>T.c.</i> , <i>T.n.</i> |
| 7 | 13.11.1986 | Jebel Said, 60 km SE of Medinah; pool in wide wadi | ca 650 | 23°49'N 40°57'E | BÜTTIKER (1985) | <i>E.p.</i> , <i>L.m.</i> |
| 8 | 26.04.1985 | Wadi Tima, temporary pool, in wadi bed, river in floods some 2-4 weeks ago; source of water in basic rock area but also in lava fields | 1000 | 23°44'N 39°47'E | BÜTTIKER (1985) | <i>B.sch.</i> , <i>S. sp.</i> , <i>T.n.</i> , <i>E.p.</i> , <i>L.m.</i> |
| 9 | 05.05.1985 | Qaba, temporary pool near flooded river; river from granitic basic rock catchment area; confluents from lava fields too | 640 | 24°27'N 39°13'E | BÜTTIKER (1985) | <i>S. sp.</i> , <i>E.p.</i> |
| 10 | 05.05.1985 | Wadi ar-Rimah, same as Qaba | 1000 | 26°06'N 40°51'E | BÜTTIKER (1985) | <i>S. sp.</i> , <i>E.p.</i> |
| 11 | 28-31.05.1985 | Al-Uqdah, small temporary pools on flat highland plateau (granitic/gneissic rocks); <i>Juniperus procera</i> trees of good growth in neighbourhood | 1780 | 21°07'N 40°25'E | BÜTTIKER (1985) | <i>S. sp.</i> |
| 12 | 1987 | Dahl Sabsab, ca 85 km E of Ma'aqalah (26°31'N 47°20'E) a dry cave (dark zone) occasionally fills partially with run-off from rare desert rains | ? | 26°21'N 48°23'E | D. Peters (specimens at the Smithsonian Institution) | <i>B.sch.</i> , <i>S.t.</i> or <i>S. sp.</i> (?) |
| 13 | 1987 | Dahl Suraywilat, near Ma'aqalah (same as above) | ? | 26°30'N 47°37'E | D. Peters (specimens at the Smithsonian Institution) | <i>B.sch.</i> |
| 14 | 27.03.1990 | Wadi al-Matran; al-Ula-Khaibar (Wadi al-Matraz) | ? | 26°03'N 38°46'E | F. Krupp & W. Schneider | <i>S.t.</i> or <i>S. sp.</i> (?) |
| 15 | 08.03.1991 | Dhahran, sea shore, roadside rainpool | sea level | 26°18'N 50°05'E | H. Dumont | <i>A. sp.</i> |
| 16 | 24.01.1992 | Jubail, Sabkhat al-Fasl, salinity of water ca 30 ‰ | sea level | 26°59'N 49°40'E | H. Dumont | <i>A. sp.</i> |

| No. | Date | Location | Alt. [m] | Coordinates | Collector | Species |
|-------|------------|---------------------------------------------------------------------------------------------------|----------|--------------------|---------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Yemen | | | | | | |
| 17 | 26.04.1990 | Kutab, 60 km S of Sana'a, village pool with pollution | ca 2300 | 15°30'N 44°22'E | H. Dumont | <i>S.t., T.c.s.</i> |
| 18 | 23.06.1990 | Robat Alshoba, wadi in mountains | ca 2300 | — | H. Dumont | <i>L.m.</i> |
| 19 | 1991 | Robat al-Sha'ry | 2350 | 14°20'N 44°21'E | AL-SAFADI (1991) | <i>T.n., L.m.</i> |
| 20 | 1991 | Al-Massajd, 30 km W of Sana'a | 2150 | 15°18'N 44°07'E | AL-SAFADI (1991) | <i>S.t., L.s.</i> |
| 21 | 1991 | Yarim | 2350 | 14°22'N 44°22'E | AL-SAFADI (1991) | <i>S.t.</i> |
| 22 | 1991 | Ma'ber | 2300 | 14°48'N 44°17'E | AL-SAFADI (1991) | <i>S.t.</i> |
| 23 | 1991 | Mafhaq | 1800 | 15°07'N 43°50'E | AL-SAFADI (1991) | <i>S.t.</i> |
| 24 | 1991 | Qabil Village | 2250 | 15°23'N 44°10'E | AL-SAFADI (1991) | <i>S.t.</i> |
| 25 | 1991 | Al-Ahgor | 2300 | 15°31'N 43°52'E | AL-SAFADI (1991) | <i>S.t.</i> |
| 26 | 1991 | Nahim | 1800 | 15°41'N 44°40'E | AL-SAFADI (1991) | <i>S.t.</i> |
| 27 | 1939 | Jebel Jihaf = Sana'a; 6 ♂♂, 11 ♀♀, BMNH 1939.10.25.1-20 | 2200 | 15°30'N 44°22'E | | <i>S.n.</i> |
| 28 | 1962 | Rassaiss, Wadi Habib, 1 ♂, 5 ♀♀, BMNH 1962.5.21.1 | ca 2200 | 15°22'N 44°10'E | | <i>S.n.</i> |
| 29 | 1954 | Jebeid nr. Wadi Dam, 12 ♂♂, 10 ♀♀, BMNH 1954.7.8.1 | ca 2200 | 15°20'N 44°05'E | BOND (1934) | <i>S.n.</i> |
| 30 | BMNH | Sirah Batawil Lisarab, Hadramaut | — | ca 14°20'N 48°10'E | HARDING (1941) | <i>E.m., L.s.</i> |
| Oman | | | | | | |
| 31 | 09.03.1982 | Bukaratub near Yalooni (ONHM 729.5) | 140 | 20°11'N 57°07'E | D. Chatty | <i>Triops cancriformis</i> (?), det. G.A. Boxhall, BMNH, 12.VI.1982, & H.J. Dumont 22.II.1989, not seen (in ONHM); determination doubtful, to be confirmed |
| 32 | 20.04.1982 | Bukaratub near Yalooni, on stony plateau (ONHM 729.1, 729.2, 729.3, 729.4) | 140 | 20°11'N 57°07'E | M.D. Gallagher (MDG 6422) | <i>B. n. sp., T.n., E.p.</i> |
| 33 | 04.03.1983 | Majur Airstrip (ONHM 743) | 110 | 21°16'N 56°30'E | M.R. Brown | <i>Triops numidicus</i> (= <i>T. granarius</i>), det. H.J. Dumont, Gent, II.1989, not seen (in Gent) |
| 34 | 21.04.1983 | Wadi bu Mudhabi 51 km E of Haima (ONHM 744) | 130 | 19°54'N 55°47'E | K. Nievens (MDG 6745) | <i>Triops numidicus</i> (= <i>T. granarius</i>), det. H.J. Dumont, Gent, II.1989, not seen (in ONHM) |
| 35 | 28.03.1987 | Wadi al-Qaynah, E border of Wahiba Sands, S of Bilad Bani Bu Ali, quartz sand and mud (ONHM 2319) | 80 | 21°48'N 59°20'E | M.D. Gallagher (MDG 7951) | <i>Eocyclus plumosus</i> , det. H.J. Dumont, Gent, II.1989, not seen (in ONHM) |
| 36 | 24.04.1987 | near Rusayl, limestone mud of temporary rainwater pool at roadside (ONHM 2320) | 30 | 23°34'N 58°12'E | M.D. Gallagher (MDG 7955) | <i>Eocyclus plumosus</i> , det. H.J. Dumont, Gent, II.1989, not seen (in ONHM) |
| 37 | 09.05.1989 | Azaiba, near Sib airport, limestone mud of shallow rainwater pool at roadside (ONHM 1474) | 15 | 23°35'N 58°20'E | M.D. Gallagher (MDG 8136) | <i>E.m.</i> |
| 38 | 17.03.1990 | Haylat Daly (Grid Reference: EH 3107), Yalooni 221, 222 (ONHM 1506.1, 1506.2) | 150 | 19°57'N 57°18'E | A.J. Spalton | <i>T.n.</i> |
| 39 | 18.03.1990 | Khatan Abu Rashid (E) (Grid Reference: EH 2562), Yalooni 223 (ONHM 1506.3) | 150 | 20°27'N 57°14'E | collector not known | <i>T.n.</i> |
| 40 | 18.03.1990 | Khatan (W) (Grid Reference: EH 2162), Yalooni 224 (ONHM 1506.4) | 150 | 20°27'N 57°12'E | collector not known | <i>T.n.</i> |

| No. | Date | Location | Alt. [m] | Coordinates | Collector | Species |
|-----|-----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|--------------------|---------------------|-------------------------------------------------------------|
| 41 | 19.03.1990 | Msaifr (Grid Reference: EG 0297), Yalooni 225 (ONHM 1506.5) | 150 | 19°52'N 57°01'E | Kasab bin Dooda | <i>T.n.</i> |
| 42 | 23.03.1990 | Haima, 20 km from Haima pool, South Oman | 120 | 19°55'N 56°19'E | collector not known | <i>E.p.</i> |
| 43 | 24.03.1990 | Two temporary pools near Yalooni, Jiddat al-Harasis, shallow water in the gravel desert, no algae, muddy water, maximum depth 30-45 cm (UTM references = Zone 40Q E 510 800 N 2205450) | 150 | 19°56'N 56°06'E | R. Victor | <i>T.n.</i> |
| 44 | 27.03.1990 | Meyhews (Grid Reference: EH 3212), Yalooni 232 (ONHM 1520.1) | 50-150 | 20°00'N 57°17'E | A.J. Spalton | in Gent; not seen |
| 45 | 27.03.1990 | Bulkharait, Huqf (Grid Reference: EH 3705), Yalooni 233, 235, 236 (ONHM 1520.2, 1520.4, 1520.5) | 50-150 | 19°57'N 57°21'E | A.J. Spalton | <i>B. n. sp.</i> , ONHM 1520.2 and 1520.5 in Gent, not seen |
| 46 | 27.03.1990 | Haylat Daly, Huqf: ephemeral freshwater pool (Grid Reference: EH 3107), Yalooni 234 (ONHM 1520.3) | 150 | 19°57'N 57°18'E | A.J. Spalton | <i>B. n. sp.</i> |
| 47 | 03.04.1990 | Yalooni (Central Oman), the remnants of one temporary pool | 150 | 19°56'N 57°06'E | collector not known | <i>B.sch.</i> , <i>T.n.</i> |
| 48 | 15.03. and 20.03.1991 | Huqf (= abrupt cliff edge of the plain called Jiddat al-Harasis); all pool bottoms are limestone mud; two samples (ONHM 1793) | 50-150 | 20°03'N 57°17'E | E.R.L. Jones | <i>E.p.</i> |
| 49 | 03.05.1992 | Darabyl rainwater pool after April floods, Yalooni 350, 351 (ONHM 2053.1) | 150 | 20°26'N 56°50'E | collector not known | <i>T.n.</i> |
| 50 | 06.05.1992 | Daratheem rainwater pool after April floods, Yalooni 352, 353 (ONHM 2053.2) | 150 | 20°17'N 57°06'E | collector not known | <i>T.n.</i> |
| 51 | 03.04.1994 | Near Yalooni, the remnants of one pool | 154 | ca 19°56'N 57°06'E | collector not known | <i>E.p.</i> |
| 52 | 27.06.1994 | Wadi Dirif after flood on 9 June in limestone hills (ONHM 2360) | < 100 | 19°08'N 57°18'E | E.R.L. Jones | <i>E.p.</i> |
| 53 | 11.03.1995 | Jiddat al-Harasis, shallow pool (ONHM 2438.1, 2438.2) | 180 | 20°00'N 57°16'E | M. Laurence | <i>B. n. sp.</i> , <i>T.n.</i> |
| 54 | 25.03.1995 | Pond life from the Jiddat, Haylat Yalooni, sandy substrate (ONHM 2455, 2456, 2457) | 154 | 19°56'N 57°06'E | M. Laurence | <i>B. n. sp.</i> , <i>T.n.</i> , <i>E.p.</i> , <i>L.m.</i> |

Oman, Eastern Wahiba Sands Project, 1986

| | | | | | | |
|----|---------------|---------------------------------------------------------------------------------------------------------------------------------|-----|-----------------|----------------------------|-----------------------------------------|
| 55 | 22.02.1986 | Wadi al-Batha, temporary pool near Bilad Bani Bu Hassan and Mintirib/Kamil, on limestone underground; presence of <i>Acacia</i> | 160 | 21°59'N 59°20'E | BÜTTIKER & BÜTTIKER (1988) | <i>B.s.</i> , <i>E.p.</i> |
| 56 | 28.02.1986 | Mintirib, Wadi al-Batha | 268 | 22°26'N 58°48'E | BÜTTIKER & BÜTTIKER (1988) | <i>E.m.</i> |
| 57 | 01.03.1986 | Mintirib, Research Camp, 2 km SW | 269 | 22°25'N 58°49'E | BÜTTIKER & BÜTTIKER (1988) | <i>E.m.</i> |
| 58 | 04.03.1986 | Hamad, temporary pool on limestone underground, gravel and limestone boulders | 900 | 23°00'N 59°15'E | BÜTTIKER & BÜTTIKER (1988) | <i>E.m.</i> |
| 59 | 06-10.03.1986 | Shaqq, wadi pond on riverside after rivers in flood; alluvial calcareous gravel of different origin; two samples | 55 | 21°08'N 58°16'E | BÜTTIKER & BÜTTIKER (1988) | <i>B.s.</i> , <i>E.p.</i> , <i>E.m.</i> |
| 60 | 22.03.1986 | Sayq road, pool | 275 | 21°07'N 58°10'E | BÜTTIKER & BÜTTIKER (1988) | <i>E.m.</i> |

| No. | Date | Location | Alt. [m] | Coordinates | Collector | Species |
|-------|------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|-----------------|-------------------------|-----------------------------------------|
| Syria | | | | | | |
| 61 | 25.03.1977 | Wadi al-Harir, Damascus-Deraa Road, 25 km NE of Deraa, Nahr al-Harir; intermittent stream, high water level, slow-flowing, turbid water, stagnant pool with silt and aquatic vegetation <i>Ranunculus</i> dominant; <i>Juncus</i> grassland | — | 32°53'N 36°10'E | R. Kinzelbach et al. | <i>L.c.</i> , <i>C.g.</i> |
| 62 | 20.03.1980 | Damascus-Qunaitra, 3 km SW of Sasa, pond fed by small spring (Ain Safsaf) and streamflow, lush submersed and emersed vegetation e.g. <i>Juncus</i> , <i>Alisma</i> , <i>Ranunculus</i> | — | 33°16'N 36°00'E | R. Kinzelbach et al. | <i>C.n.</i> , <i>L.c.</i> , <i>C.g.</i> |
| 63 | 24.06.1980 | Antique site of Busra as-Sam, theatre; temporary rainpool below the stage; very shallow with few algae | — | 32°31'N 36°29'E | W. Schneider & F. Krupp | <i>C.g.</i> |

The *Ocypode* ghost crabs (Crustacea: Decapoda: Brachyura) of the Arabian Peninsula and Adjacent Regions

Michael Türkay, Katsushi Sakai and Michael Apel

Abstract: Four species of ghost crabs occur on the sandy beaches of the Arabian Peninsula: *Ocypode cordimanus*, *O. jousseaumei*, *O. rotundata*, and *O. saratan*. Useful information and figures for the identification of adults and juveniles are presented together with a key. The distribution of the species clearly shows that the Arabian fauna differs from those of East Africa and of India.

السرطان الشبح *Ocypode* (صنف القشريات : رتبة عشاريات الأرجل : قصيرة الذنب) في شبه الجزيرة العربية والمناطق المجاورة

ميخائيل تركاي، كاتسوشي ساكاي وميخائيل آبل

خلاصة : توجد أربعة أنواع من السرطان الشبح في الشواطئ الرملية لشبه الجزيرة العربية وهي : *Ocypode cordimanus*، *O. jousseaumei*، *O. rotundata* و *O. saratan*. يتضمن هذا البحث معلومات مفيدة ورسوم لتشخيص الحيوانات البالغة واليافعة موضحة بمفتاح تصنيفي. ويبين توزيع الأنواع بأن المجموعة الحيوانية العربية تختلف عن تلك الموجودة في شرق أفريقيا وفي الهند.

INTRODUCTION

Ghost crabs of the genus *Ocypode* are dominant elements of tropical and subtropical sandy beaches. The systematics of this genus still poses some problems as it contains a number of species with restricted distribution for which little material is available. Another problem is the identification of juveniles which are often confused as they look very similar and do not show the adult characters. The present paper is part of the revision of the ghost crabs of the world and aims at characterising the species from the shores of the Arabian Peninsula and giving information for their identification.

The geographic range treated in this study is restricted to the region in which a typically Arabian fauna occurs. It covers all Red Sea coasts, the Gulf of Aden and the Arabian Gulf. Within these borders, including at least the western part of Pakistan, it may be used for identifying material collected from sandy beaches. There is only one exception: the shores of the Island of Socotra, where additionally *O. ceratophthalma* (Pallas, 1772) and *O. ryderi* Kingsley, 1880 occur. This island is, therefore, clearly influenced by the east African fauna.

In compiling the information for this paper some points have been limited. The references listed under the more widely distributed species correspond only to the area described. Also, for

the common Red Sea species *O. saratan*, the numerous references listed in LEWINSOHN (1977) are not repeated and supplementary older and newer ones are given. For further references the former paper can be used.

All measurements are given in millimetres.

Abbreviations

| | |
|-------|------------------------------------------------------------------|
| BH | body height |
| CB | carapace breadth |
| CL | carapace length |
| FB | frontal breadth |
| MCSNG | Museo Civico di Storia Naturale Giacomo Doria, Genova |
| MCSNM | Museo Civico di Storia Naturale, Milano |
| MNHN | Muséum National d'Histoire Naturelle, Paris |
| MZUT | Museo di Zoologia dell'Università di Torino |
| NHML | The Natural History Museum, London |
| NHMW | Naturhistorisches Museum, Wien |
| NNHM | Nationaal Natuurhistorisch Museum, Leiden |
| NRMSt | Naturhistoriska Riksmuseet, Stockholm |
| SMF | Senckenberg-Museum, Frankfurt a.M. |
| USNM | United States National Museum, Washington, D.C. |
| UZMK | Universitetets Zoologiske Museum, København |
| ZMB | Zoologisches Museum der Humboldt-Universität, Berlin |
| ZMG | Zoologisches Museum der Universität Göttingen [deposited at SMF] |
| ZMH | Zoologisches Museum Hamburg |
| ZMK | Zoologisches Museum, Kiel |
| ZSM | Zoologische Staatssammlung, München |

SYSTEMATIC ACCOUNT

Ocypode cordimanus Latreille, 1818 (Figs 1-3, 11)

Ocypode cordimanus Latreille, 1818. — Nouv. Dict. Hist. Nat: 198.

Ocypode cordimana. — Kossmann 1877: 55; ? Laurie 1915: 416; Stella 1953: 66; Lewinsohn 1977: 54.

Ocypoda cordimana. — Nobili 1906 a: 310.

Ocypode aegyptiaca. — Balss, 1924 [part.]



Fig. 1: *Ocypode cordimanus*, neotype SMF 1948.

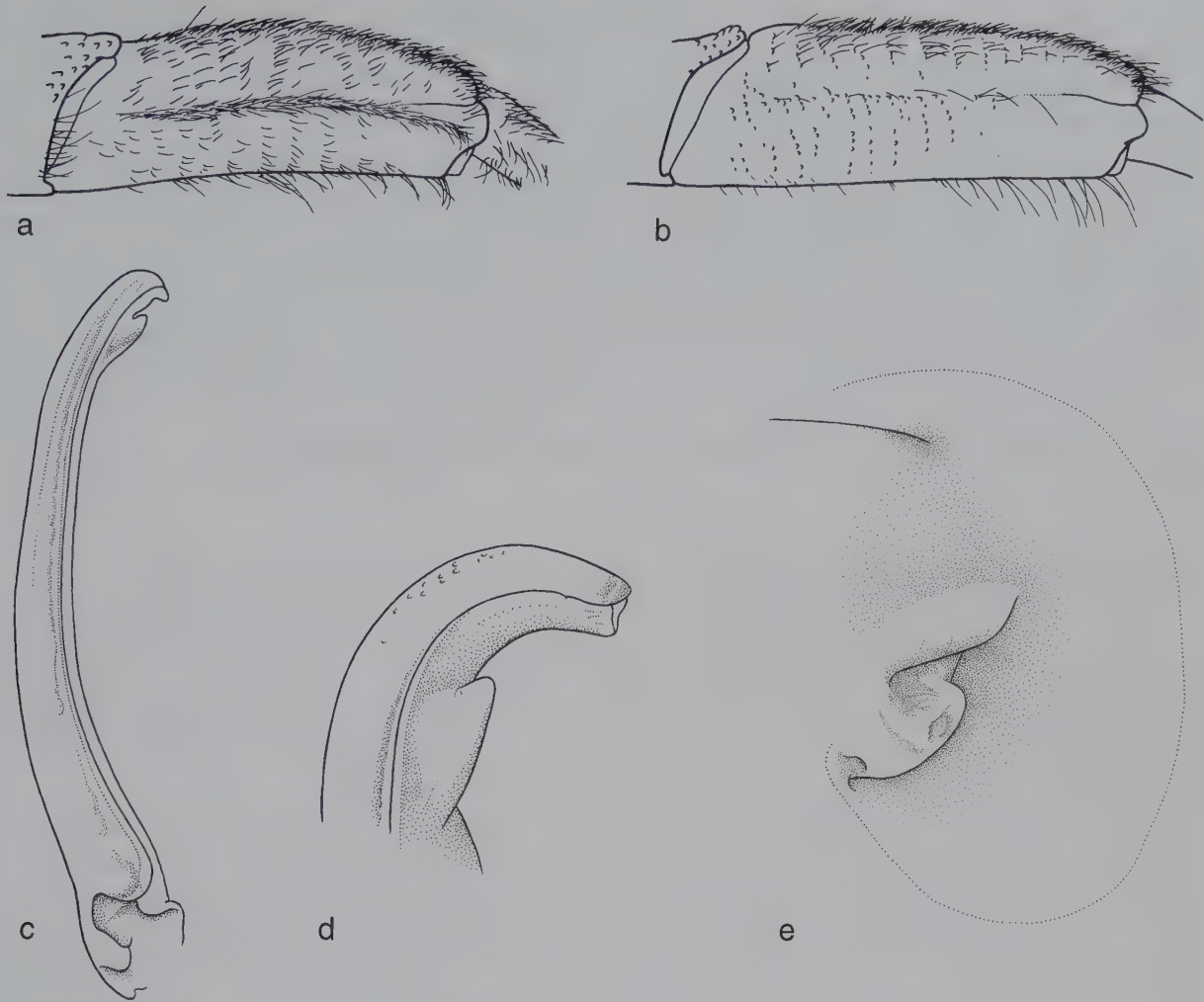


Fig. 2: *Ocypode cordimanus*, morphology of taxonomically important characters: a, propodus of second pereiopod, anterior face; b, propodus of third pereiopod, anterior face; c, male first pleopod, total; d, same, distal part; e, female genital duct.

Material: Red Sea: Egypt: 2 ♂♂, Gulf of Aqaba, Dhahab, 28.III.1973, L.B. Holthuis & C. Lewinsohn, NNHM 29238. — Saudi Arabia: 1 ♂, Naman Island, 8.X.1896, S.M.S. "Pola", NHMW; 1 ♂, same data, 30.X.1896, NHMW. — Eritrea: 1 ♀, Massawa, 1903, ded. Clivio, MZUT 1102; 2 juvs, same locality, mudflat with halophyte vegetation, XII.1965, K.E. Linsenmair, SMF 6749. — Gulf of Aden: Yemen: 1 ♂, Aden, MCSNM 2158; 1 ♀, Mukalla, NHML 1894.10.31.13.

Diagnosis: Middle-sized animals. Eyestalks not extended beyond cornea. Exorbital tooth broadly triangular and clearly protruding. Inner surface of palm of major chela without stridulating ridge. Small chela with both fingers pointed. Anterior face of propodi of second pereiopods with a row of hairs along median line. Same joint of third pereiopod naked. Male first pleopod abruptly narrowed distally, its distal part slightly bent laterally, palp short and angular, its distance to pleopod tip much longer than palp length. Opercle of female genital duct distally rounded, knob-shaped, and protruding mesially, vulva-opening oblique with respect to median line of sternum.

Description of juveniles: In young specimens the exorbital tooth is more effiliated than in adults and very acute. The setation of the propodi of the second and third pereiopods is similar in pattern to that of the adults, the hairs of the upper border are as long as those of median line and not reduced to bristles as is the case in adults.

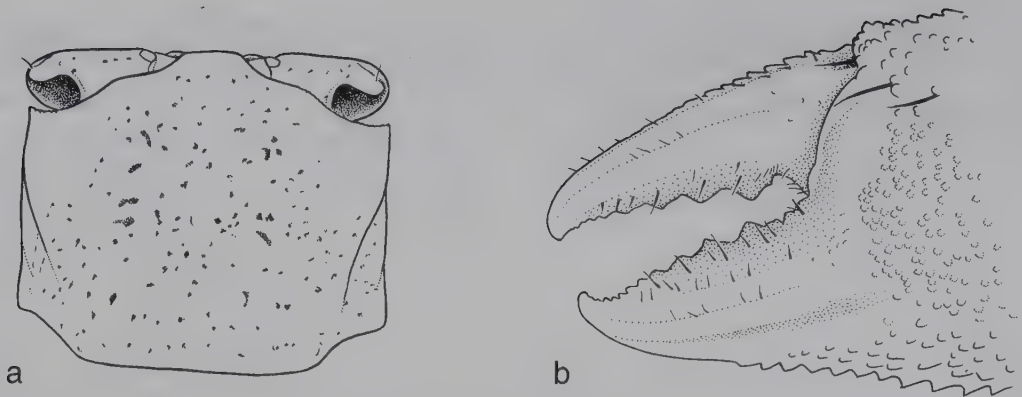


Fig. 3: *Ocypode cordimanus*, juvenile, CB 8.5 (SMF 9897): a, carapace; b, inner face of larger cheliped.

Measurements of neotype ♂: CB 37.3, CL 34.0, BH 27.8, FB 5.2.

Typical locality: Bertrand Island [= Tendanye], N of New Guinea (locality of neotype).

Distribution: Indopacific Ocean, from the Red Sea and East Africa to the South Seas and southern Japan. To date unknown from the Arabian Gulf region.

Remarks: The identity of this common and widely distributed species posed some problems as the original description included more than one species. The common usage of the name was stabilised by SAKAI & TÜRKEY (1977) through designation of a neotype.

The status and distribution of the present species in the Red Sea area has been discussed in detail by LEWINSOHN (1977). According to his and our data it is not common but probably present all over the Red Sea coasts. Its presence in the Gulf of Aden is demonstrated for the first time in this paper. Until now there are no records from the Gulf area. Outside the region treated in this paper the species is common and dominant on all Indopacific coasts where it is more terrestrial than other species, i.e. living in upper shore dunes and not on the beach. In east Africa it occurs regularly from Cape Hafun (Somalia) southwards to South Africa.

Ocypode jousseaumei (Nobili, 1905) (Figs 4-6, 11)

Ocypoda Jousseaumei Nobili, 1905. — Bull. Mus. Hist. nat. 11: 233, Fig. 2.

Ocypoda Jousseaumei. — Nobili 1906 a: 310.

Ocypode jousseaumei. — Laurie 1915: 416; Crosnier 1965: 99, text-figs 156, 163, 173-174, Taf. 10: Figs 2, 6; Serene 1968: 97.



Fig. 4: *Ocypode jousseaumei* from Tauwati (NHMW).

Material: Red Sea: 1 ♂ (holotype), "Mer Rouge", MNHN B11782. — Djibouti: 2 ♂♂, 1 juv. ♂, 3 juv. ♀♀, no exact locality, ZMB 15639; 2 juv. ♂♂, Tadjoura, ZMH K2927. — Yemen: 1 juv. ♂, 2 juv. ♀♀, 2 juvs, Aden, ZMB 5878; 1 ♂, Aden, USNM 64745; 1 ♂, Tauwati, NHMW.

Diagnosis: Middle-sized to small animals. Eyestalks not extended beyond cornea. Exorbital tooth triangular, conspicuously tapering and clearly protruding. Stridulating ridge on inner surface of palm of major chela composed of 72-79 elements gradually intergrading from tubercles at upper part into striae at lower part. Small chela with both fingers pointed. Anterior face of propodi of second pereiopods with a row of bristles on upper border and a row of hairs along median line. Same joint of third pereiopod with a row of bristles on upper border only. Male first pleopod slightly tapering distally, its distal part clearly bent laterally, palp short and conical, its distance to pleopod tip as long as palp length.

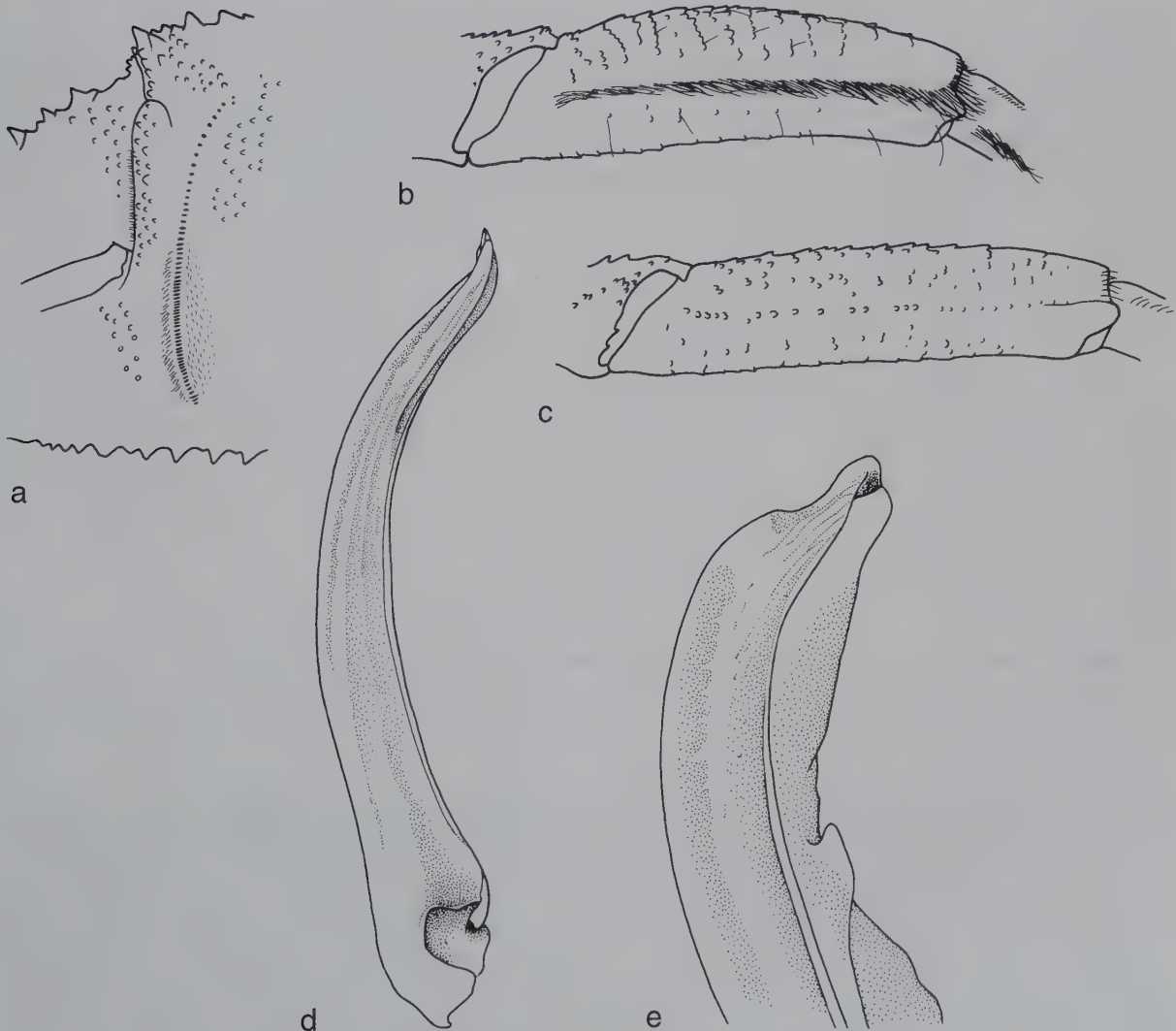


Fig. 5: *Ocypode jousseaumei*, morphology of taxonomically important characters: a, part of inner face of larger cheliped with stridulating ridge; b, propodus of second pereiopod, anterior face; c, propodus of third pereiopod, anterior face; d, male first pleopod, total; e, same, distal part.

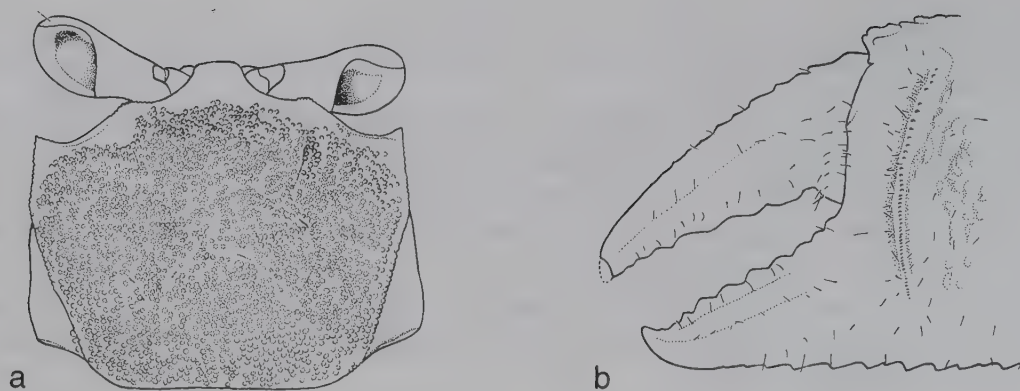


Fig. 6: *Ocypode jousseaumei*, juvenile, CB 7.8 (ZMB 9897): a, carapace; b, inner face of larger cheliped.

Description of juveniles: Only very few juveniles are known. Specimens with CB 7.8 and CL 9.0 (ZMB 5878) have a granulated carapace. The exorbital teeth are much less protruding than in adults, this results in the feature that the supraorbital border lateral of the median lobe is directed obliquely backwards. The stridulating crest is already shaped in the ordinary way, beginning dorsally with tubercles which gradually intergrade into striae. The anterior faces of the propodi of the second pereopods bear a median hair row, same joints of third pereopods sparsely hairy.

Measurements of holotype ♂: CB 38.5, CL 36.5, BH 27.0, FB 4.5.

Typical locality: Red Sea, rectified to Obock by NOBILI (1906 a).

Distribution: Up to now only known with certainty from the innermost Gulf of Aden.

Remarks: The typical locality of the present species was originally stated as Red Sea but later corrected by the same author (NOBILI 1906 a) to Obock (currently in Republic Djibouti). It has never been subsequently recorded from the Red Sea (LEWINSOHN 1977). The small number of specimens hitherto known indicates a very localised distribution in the inner Gulf of Aden and may be misinterpreted as rareness. In fact, nothing is known on its distribution and ecology as our present knowledge is restricted to the material listed above.

Ocypode rotundata Miers, 1882 (Figs 7-8, 12, Plates 1-3)

Ocypoda rotundata Miers, 1882. — Ann. Mag. nat. Hist (5) 2: 378, 382, Plate 17: Fig. 4.

Ocypoda rotundata. — Ortmann 1897: 360, 364; Alcock 1900: 348; Chhapgar 1956: 508; Chhapgar 1957: 46, 66, Plate 13: Figs g-i; Hashmi 1963: 240.

Ocypoda rotundata var. *arabica* Nobili, 1906 b. — Bull. Sci. Fr. Belg. 40: 152, Plate 5: Fig. 26.

Ocypode aegyptiaca. — Stephensen 1945: 188, Fig. 55. [nec *Ocypode aegyptiaca* Gerstaecker, 1856].

Ocypode rotundata. — Pretzmann 1971: 480, Plate 4: Figs 8-10; Pretzmann 1975: 1-2; Tirmizi 1980: 109; Tirmizi & Kazmi 1983: 371, 377; Titgen 1982: 152.

Ocypode saratan. — Basson et al. 1977: 38, 40, 56, 60, 126, 140, 145, Fig. 14; Jones 1986: 157, Plate 42; Hogarth 1989: 103, 115 [nec *Cancer saratan* Forskål, 1775].

Material: 1 ♂ (holotype), "Dukhun", NHML 79.32. — Gulf of Oman: Oman: 2 ♂♂, Muscat, NHML 1898.4.14.3-4; 1 ♂, Al Khasab, NHML 1973.167; 1 ♀, same locality, NHML 1973.170; 2 ♀♀, 1 juv. ♂, 2 juv. ♀♀, Al Khuwayr, Batinah, 23°36'N 58°25'E, 28.VI.1988, M.D. Gallagher, SMF 18285. — United Arab Emirates: 4 ♂♂, 9 ♀♀, Fujairah, N of Khor Fakkan, 25°30'N 56°22'E, SMF 23035. — Arabian Gulf: 1 ♀, no specific locality, NHML 1962.8.30.5. — United Arab Emirates: 1 ♀, Ash Shariqah (= "Sharjah"), NHML 1971.32. — Saudi Arabia: 1 ♂, Ras At Tannurah, NNHM 15616; 1 ♂, same locality, USNM 207674; 2 ♂♂, 2 ♀♀, Jazirat Abu Ali, 27°20'N 49°33'E, NHML 1974.386; 1 ♂, same locality, 27°21'N 49°30'E, SMF 23028; 2 ♂♂, 3 ♀♀, same locality, 27°21'N 49°30'E, SMF 23029; 1 ♂,

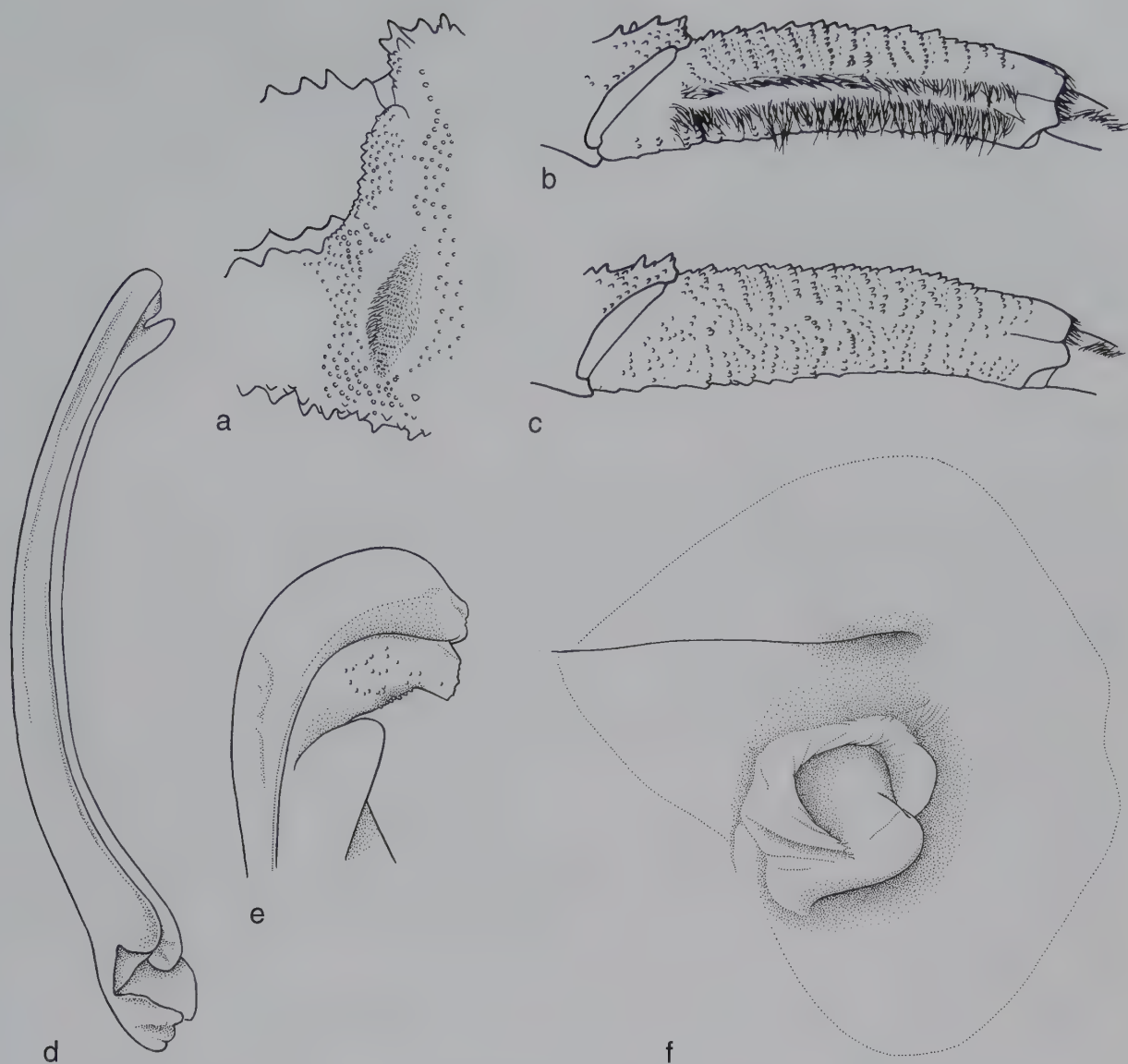


Fig. 7: *Ocypode rotundata*, morphology of taxonomically important characters: a, part of inner face of larger cheliped with stridulating ridge; b, propodus of second pereopod, anterior face; c, propodus of third pereopod, anterior face; d, male first pleopod, total; e, same, distal part; f, female genital duct.

2 ♀♀, same locality, 27°18'N 49°42'E, SMF 23030; 1 ♂, 2 ♀♀, same locality, 27°18'N 49°42'E, SMF 23031; 2 ♂♂, 2 ♀♀, same locality, 27°18'N 49°41'E, SMF 23033; 1 ♀, Ras Az Zawr, 27°27'N 49°18'E, SMF 23032; 1 ♀, Jazirat Karan, 27°42'N 49°49'E, SMF 23027; 2 ♂♂, 2 ♀♀, same locality, SMF 23034. — Iran: 4 ♂♂, 3 ♀♀, no specific locality, NHMW; 2 ♂♂, specimens of STEPHENSEN (1945), coral reef S of Bushehr (= "Bouchir"), UZMK; 2 ♀♀, specimens of STEPHENSEN (1945), Jazireh-ye Shotur (= "Jez Shit war", rectified to Jazireh-ye Shitvar), 26°47'N 53°25'E, UZMK; 11 ♂♂, 1 ♀, specimens of PRETZMANN (1971), Bandar Abbas, NHMW; 2 ♂♂, same locality, NHMW 3805; 1 juv. ♂, 6 juv. ♀♀, same locality, NHMW 3806. — Arabian Sea: 1 ♂, holotype of *Ocypoda rotundata* var. *arabica*, Al Hallaniyah Island, 17°30'N 56°01'E, MNHN. — Pakistan: 1 ♂, sandy beach at Horst Point, W of Karachi, UZMK; 1 ♀, Karachi, NHML 1897.9.12.2; 2 spms, same locality, NHML 1911.1.17.72-73; 1 juv. ♂, same locality, USNM 216684; 1 juv., same locality, UZMK; 1 ♀, Clifton, NHML; 1 ♂, 1 ♀, Indus-Delta, Khudi Creek, I.1974, G. Pilleri, SMF 17728.

Diagnosis: Large animals. Eyestalks extended beyond cornea (stylophthalmous). Exorbital corner rounded. Stridulating ridge on inner surface of palm of major chela composed of about

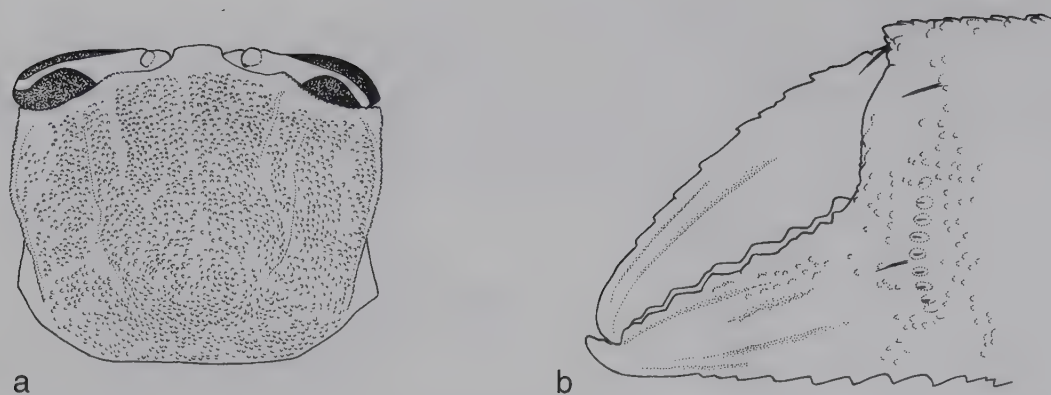


Fig. 8: *Ocypode rotundata*, juvenile, CB 13.8 (NHMW 3806): a, carapace; b, inner face of larger cheliped.

10-15 striae, themselves made up of granules. Small chela with both fingers rounded at tip. Anterior face of propodi of second pereopods with two rows of hairs along median line. All other faces of same joints of the remaining pereopods naked. Male first pleopod clearly broadened, its distal part clearly bent laterally, palp broadly rounded and conical, its distance to pleopod tip slightly more than palp length. Opercle of female genital duct distally rounded, knob-shaped, and protruding mesially, vulva-opening oblique with respect to median line of sternum.

Description of juveniles: The stylophthalmost prolongation of the eyestalks beyond the tip of cornea is not present in specimens with CB 13.8 and CL 15.8, while small prolongations are evident in specimens of CB 19.7, CL 22.9 and CB 22.5, CL 26.6 (NHMW 3806). The external half of the upper orbital border is concave and the exorbital corner is marked. Antero-lateral borders straight, with clear epibranchial corner. Palm of larger chela relatively longer and less broad compared with chelae of adults. Stridulating ridge composed of 10-11 distinct striae, themselves built up of granules. Anterior faces of propodi of second pereopods with a few sparse hairs along midline. All other faces of same joints of remaining pereopods naked besides small yellow bristles at their distal borders.

Measurements of ♂ (SMF 6748): CB 59.2, CL 50.2, BH 35.3, FB 6.0.

Typical locality: "Dukhun".

Distribution: South-eastern coast of the Arabian Peninsula (Oman) up to North India (northern Gujarat State), including the Arabian Gulf.

Remarks: The present species is very similar in gross morphology to *O. saratan* from the Red Sea and adjacent areas and has at times been treated as conspecific with it. Hence the record of *O. aegyptiaca* from the Arabian Gulf by STEPHENSEN (1945) becomes understandable. In fact, a re-examination of the respective material confirmed the latter's identity with the present species. The distinction between the two species is made easy from the morphology of the stridulating ridge. In *O. saratan* this organ is composed of 67-87 striae, in *O. rotundata* in contrast, of 10-15 striae. Also the male first pleopods are different (Figs 7 d, e; 9 d, e).

The form described by NOBILI (1906 b) under the name *Ocypode rotundata* var. *arabica* is distinguished from the nominate species by an evident external orbital corner. This feature is characteristic of juveniles, as stated above. In fact, the re-examination of the holotype confirmed that the specimen is a juvenile of *O. rotundata* proper and cannot be distinguished from the nominate form even infrasubspecifically.

The typical locality of the present species is not quite clear. MIERS (1882) stated: "The specimen, which is much mutilated, is labelled "Dukhun, Col. Sykes" (coll. Indian Museum), and

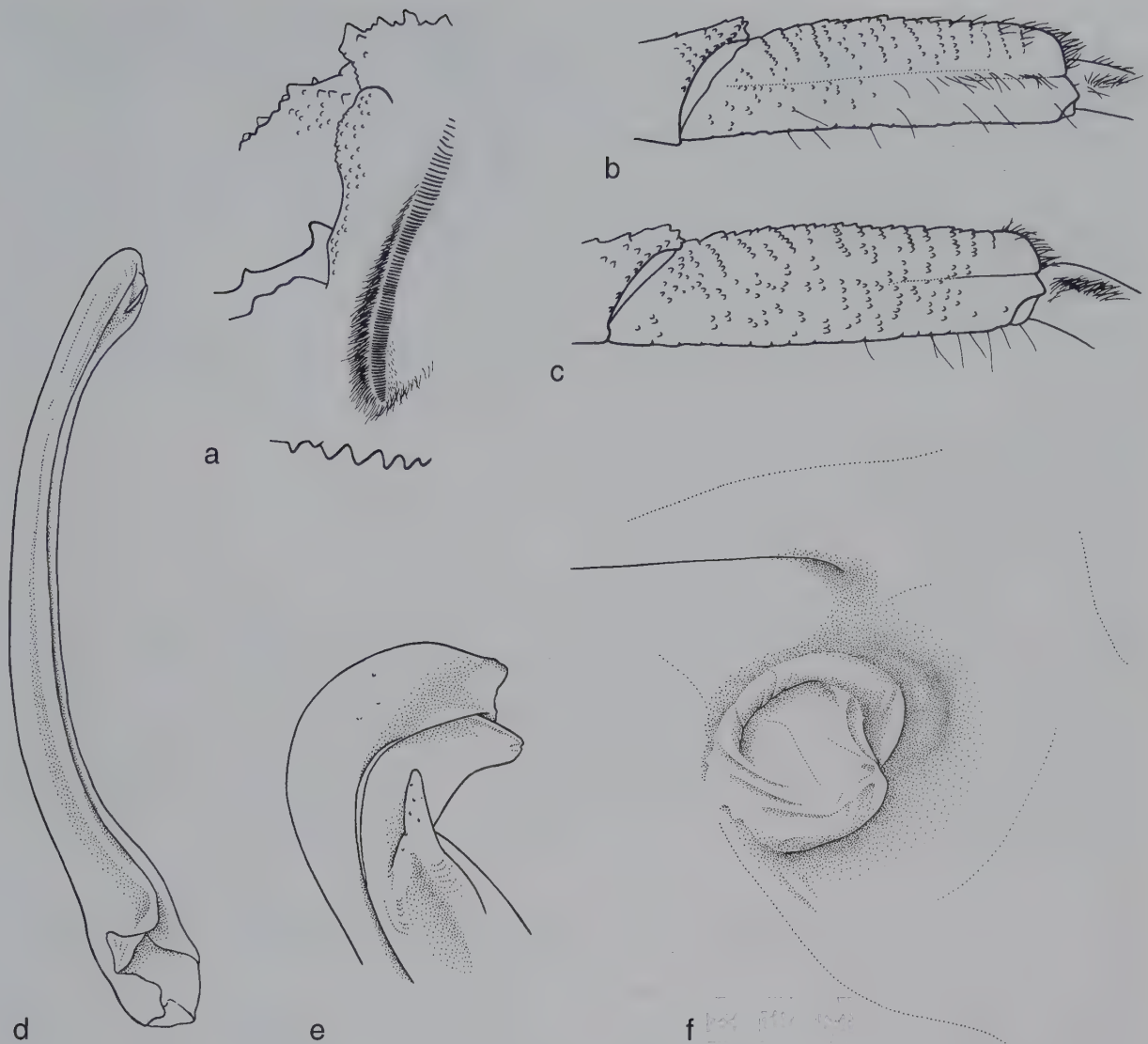


Fig. 9: *Ocypode saratan*, morphology of taxonomically important characters: a, part of inner face of larger cheliped with stridulating ridge; b, propodus of second pereiopod, anterior face; c, propodus of third pereiopod, anterior face; d, male first pleopod, total; e, same, distal part; f, female genital duct.

was probably obtained at some locality on the western coast of India.” This shows that it is by no means sure that the typical locality is “India” as often cited in the literature. Possibly “Dukhun” corresponds to Dukhan on the coast of Qatar rather than to an Indian locality. The holotype is nevertheless, clearly identical with the Gulf species.

Ocypode saratan (Forskål, 1775) (Figs 9-10, 12; Plates 4-6)

Cancer saratan Forskål, 1775. — Descr. anim.: 87.

Ocypode saratan. — Olivier 1811: 414, 416; de Haan 1835: 29; George & Knott 1965: 19, Fig. 3; Serene 1968: 97; Carli 1969: 57, 62, 63-76, text-figs 1-5; Lewinsohn 1977: 48; Vannini & Valmori 1981: 205, Figs 1 B, 2 B₁₋₂, 3 B, 4 B.

Ocypode aegyptiaca Gerstaecker, 1856. — Arch. Naturg. 22 (1): 134.

Ocypode aegyptiaca. — Heller 1861: 361, 292; Ortmann 1894: 762, 769; Ortmann 1897: 360, 366.

Ocypode cordimana. — Heller 1861: 361, 292 [nec *Ocypode cordimana* Latreille, 1818].

Ocypode aegypticus [sic]. — Serene 1968: 97.

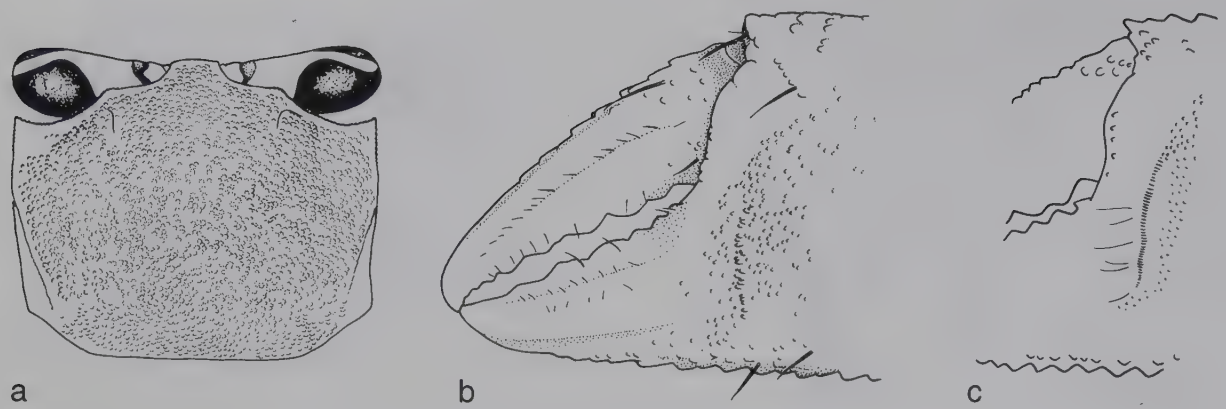


Fig. 10: *Ocypode saratan*, juvenile, CB 12.5 (ZMG 131): a, carapace; b, inner face of larger cheliped; c, same structure, juvenile CB 22.5 (NNHM D2720).

Material: Red Sea: without specific locality: 1 ♂, ZMH K2960; 1 ♂, 4 juv. ♀♀, E. Rüppell, SMF 1935; 1 ♀, E. Rüppell, SMF 6746; 1 ♀, Bannwarth, SMF 1961; 1 juv., vend. Kapt. Pöhl, ZMG 131; 1 ♀, MNHN 3295; 2 ♂♂, "Compagnie de l'Isthme Suez", MNHN; 1 ♂, N/O "Calypso", MNHN; 1 spm., Clot Bey, MNHN 3281; 2 spms, Clot Bey, MNHN 3282; 2 spms, Beaudoin, MNHN 3283; 1 ♂, 1 ♀, NNHM 237; 5 ♂♂, NHMW; 1 ♂, Gulf of Aqaba, NHML 78.25. — Saudi Arabia: 1 ♂, 1 juv. ♀, Gulf of Aqaba, Bir el Mashiyah, S.M.S. "Pola", NHMW; 1 ♂, 5 juvs, same data, ZSM; 2 ♂♂, Sanafir Islands, NHMW; 2 juv. ♂♂, Mersah Duba, S.M.S. "Pola", NHMW; 1 ♂, Habban, 26°44'N 36°32'E, S.M.S. "Pola", NHMW; 3 ♂♂, 2 juv. ♀♀, Jeddah, NNHM 236; 2 juvs, same locality, NNHM 2720; 3 ♂♂, 4 ♀♀, 10 juvs, 50 km S of Jeddah, 21°00'N 39°12'E, SMF 23037; 1 ♂, Shoiba Beach, 120 km S of Jeddah, 21.VIII.1982, W. John, SMF 10700; 1 juv., Farasan-Islands, Sarso, "Meteor"-Expedition ZMH K28635, 1 juv. ♂, same data, SMF 5417. — Yemen: 2 ♂♂, Kamaran Islands, S.M.S. "Pola" NHMW. — Egypt: 1 ♂, 1 ♀, no specific locality, MNHN 3296; 1 ♂, no specific locality, USNM 43333; 1 ♀, Sinai coast, NNHM 17722; 1 ♂, Sinai coast, Gulf of Aqaba, W. Baumeister, SMF 18277; 1 ♂, 1 ♀, Dhahab, NNHM 29236; 1 juv., same locality, S.M.S. "Pola", NHMW; 1 ♂, Abu Zabad, 40 km S of Dhahab, NNHM 12169; 1 ♀, same locality, NNHM SLR 892; 1 juv. ♂, 1 juv. ♀, Sharm el Shaykh, NNHM 12168; 1 ♀, Ras Muhammad, NNHM SLR 728; 1 ♂, 1 ♀, same locality, NNHM 11930; 2 ♂♂, 1 ♀, 1 juv. ♀, material of MIERS (1882), Gulf of Suez, NHML 6949; 2 ♂♂, Kad ed el Hamden, MNHN; 2 ♀♀, Mersa Tal Kad Yayah, MNHN; 1 ♀, Omm el Kyaman, MNHN; 2 ♂♂, 2 ♀♀, At-Tur, SMF 6747; 1 ♂, 3 ♀♀, same locality, R. Kossmann, 1874-1875, SMF 9711; 1 ♂, same locality, ZSM; 1 ♂, same locality, NNHM SLR 262; 1 ♂, 1 ♀, same locality, NNHM 1990; 1 ♀, same locality, NNHM SLR 2156; 4 ♀♀, At-Tur, Abu Galambo, NRMSt 6012; 1 ♀, El Bilaiyim, NNHM SLR 2672; 1 ♂, same locality, NNHM SLR 2702; 6 ♂♂, same locality, NNHM SLR 2891; 1 juv. ♀, same locality, NNHM 27748; 1 ♀, 10 juvs, same locality, NNHM 27228; 2 ♂♂, 1 ♀, Shadwan Island, NNHM 21934; 1 ♂, 1 ♀, same locality, NHMW; 4 ♂♂, 1 ♀, Al-Ghardaqa, UZMK; 1 ♂, 6 ♀♀, same locality, NNHM SLR 2361; 1 ♂, Ras Abu Soma, S.M.S. "Pola", NHMW; 1 ♀, 18 km S of Safaga, 26°30'N 34°05'E, SMF 23036; many juvs, Al-Qusayr, NNHM 17546; 1 ♀, 2 juvs, same locality, S.M.S. "Pola", NHMW; 1 ♂, Port Berenice, S.M.S. "Pola", NHMW; 1 ♀, Jazirat Zabbararjad, S.M.S. "Pola", NHMW; 1 ♂, 1 ♀, Mersa Halaib, USNM 97952; 5 ♂♂, 6 ♀♀, same locality, S.M.S. "Pola", NHMW; 5 ♂♂, same data, ZSM. — Sudan: 1 ♂, no specific locality, NHML 1934.1.17.118; 1 ♀, 2 juvs, Port Sudan, NHML 1955.6.9.37. — Eritrea: 1 ♂, 1 ♀, Massawa, MNHN; 3 ♂♂, 4 ♀♀, same locality, MCSNG 136-142; 1 ♂, 1 ♀, same locality, MCSNG 147; 2 ♂♂, same locality, MZUT 1108; 1 ♀, same locality, MZUT 1111; 2 ♂♂, 3 ♀♀, Abdelkader near Massawa, MZUT 1106; 1 juv. ♂, 1 juv., Sheikh Sa'id Islands near Massawa, NNHM 26863; 1 ♀, same locality, MZUT 1101; 3 ♂♂, Dahlak Archipelago, Dissei Island, MCSNG 147; 1 ♂, 2 ♀♀, Dahlak Archipelago, Entedebir Island near W-coast of Dahlak Kebir, NNHM 17822; 1 ♂, 1 juv. ♂, 1 juv. ♀, same locality, NNHM 25846; 1 ♂, Dahlak Archipelago, Cundabilu-Island ca 2 km W of Entedebir, NNHM 24767; 1 juv. ♂, 2 juv. ♀♀, Dahlak Archipelago, Museri Island near SE tip of Dahlak Kebir, NNHM 25847; 2 ♀♀, same locality, NNHM 25849; 1 ♂, Dahlak Archipelago, Seil Anbar Island, E of Museri, NNHM 25848; 2 ♂♂, Aseb, MNHN; 1 juv., same locality, NNHM 26864; 2 juv. ♂♂, 4 juv. ♀♀, 1 juv., same locality, NNHM 25846; 3 ♂♂, same locality, NNHM 25566. — Gulf of Aden: Yemen: 1 ♂, 3 ♀♀, Socotra, NHML 1906.5.18-22; 1 ♂, 1 juv. ♀, Al-Mukalla, NHML 1894.10.31.13; 1 ♀, same locality, MNHN; 1 ♀, Aden, USNM 19040; 1 ♀, same locality, USNM 43295; 2 ♂♂, 3 ♀♀, same locality, MNHN; 1 juv. ♂, same locality, NNHM 15504; 3 juvs, same locality, NNHM 15505; 1 ♂, 1 ♀, same locality, NNHM 15506; 2 juvs, same locality, NHMW; 1 ♀, same locality, MCSNG 143; 1 ♂, 3 juvs, same locality, MCSNG. — Djibouti: 1 ♂, 2 juvs, no

specific locality, MNHN; 2 juv. ♂♂, Gulf of Tadjoura, no specific locality, MZUT 1097; 1 ♂, 5 juvs, Obock, MNHN; 1 ♂, Tadjoura, MNHN; 1 ♂, same locality, MNHN. — Somalia: 1 ♂, Berbera, ZMK 1540; 1 ♂, 4 ♀♀, Kasim, MCSNM 2155. — No locality: 1 ♂, ZMH K2752; 3 juvs, SMF 1962, 2 ♀♀, MNHN. — Doubtful localities: 1 ♂, 3 ♀♀, Madota Island, MCSNG 147; 1 ♀, Shumma (? = Ras Abu Soma), MCSNG 147; 2 ♂♂, 1 ♀♀, Difnen Islands, MCSNG 147.

Diagnosis: Middle-sized to large animals. Eyestalks extended beyond cornea (stylophthalmous). Exorbital corner shortly protruding. Stridulating ridge on inner surface of palm of major chela composed of about 67-87 striae. Small chela with both fingers pointed. Anterior face of propodi of second pereopods with a broad row of hairs along median line. All other faces of same joints of the remaining pereopods naked. Male first pleopod clearly broadened, its distal part clearly bent laterally, palp with long and slender tip, its distance to pleopod tip slightly more than palp length. Opercle of female genital duct distally rounded, and protruding mesially, vulva-opening oblique with respect to median line of sternum.

Description of juveniles: Specimens with CB 6.3 and CL 5.7 (NNHM 15505) have the exorbital corners broadly triangular, in a very posterior situation and slightly protruding distally. Carapace square. Stridulating ridge not fully developed but vestiges already present. Anterior face of propodi of second pereopods with sparse hairs in median line. Propodi of the second and third pereopods with sparse yellow spines at upper border and with yellow bristles at distal end of upper border. Eyestalks do not show any stylophthalmomy.

In specimens with CB 18.7 and CL 21.7 (NNHM D2720) the eyestalks have vestiges of stylophthalmous structures, i.e. the cornea shows a slight protrusion.

Specimens with CB 22.5 and CL 25.7 (NNHM D2720) have a remarkable but still short protrusion of the eyestalk beyond the cornea. In these specimens the upper borders of the propodi of the second and third pereopods are largely naked, only the distal ends bear yellow bristles. The anterior face of the propodi of the second pereopods bear sparse hairs in their midline. The stridulating crest is composed of 50 striae. The anterolateral borders are directed outwards from base of exorbital tooth.

Measurements of ♂ (SMF 6747): CB 39.7, CL 35.1, BH 26.2, FB 5.3.

Typical locality: Red Sea, no specific locality.

Distribution: All coasts of the Red Sea, African coast of the Gulf of Aden and northeast ocean coast of Somalia up to Bedei, southern Arabian coast east to Al Mukalla. Exact distribution limits in the Gulf of Aden and the Indian Ocean coast unknown.

Remarks: The present species is common on the shores of the Red Sea and at least the western Gulf of Aden. In the Red Sea it is sympatric but not syntopic with the much rarer *O. cordimanus*. All records of other species, especially *O. ceratophthalma*, from this area proved to belong to other species. Juveniles are often misidentified and this was frequently the case for *O. ceratophthalma*. The records of this last species by VON MARTENS (1866), KOSSMANN (1877), NEUMANN (1878), NOBILI (1906 a), PARENZAN (1931), and KINGSLEY (1880) are due to such errors. All still extant specimens on which these records were based proved to be juveniles of *O. saratan*.

MONOD (1937, 1938) identified material from the Suez Canal as *O. aegyptiaca* (= *O. saratan*), this record was repeated by HOLTHUIS (1958). Upon re-examination, Monod's material proved to belong to *O. cursor* (Linnaeus, 1758). Thus, the occurrence of *O. saratan* in the Suez Canal is doubtful and not currently confirmed.

Ocypode saratan was recorded several times from outside the Red Sea and the Gulf of Aden. So far only the Somalian records of GUINOT (1962) from Hafun and VANNINI & VALMORI (1981) from Bedei are reliable. The record of HOFFMANN (1874) from Madagascar was repeated by MIERS (1878), ORTMANN (1894, 1897), and NOBILI (1906 b). L.B. Holthuis re-examined, upon our request, Hoffmann's specimens and confirmed their identity with *O. ceratophthalma* as already



1



4



2



5



3



6

Plates 1-6: 1-3, *Ocypode rotundata* at Jazirat Abu Ali (Gulf coast of Saudi Arabia). 4-6, *Ocypode saratan* from S of Port Safaga (Red Sea coast of Egypt). Photos: M. Apel.

suspected by CROSNIER (1965). Records from the Arabian Gulf by LAURIE (1915) and STEPHENSEN (1945) upon re-examination proved to be based on specimens of *O. rotundata*. As supposed by GEORGE & KNOTT (1965), the specimen recorded by BALSS (1935) from Western Australia under

the name *O. aegyptiaca* and re-examined by us proved to belong to *O. fabricii* H. Milne-Edwards, 1837.

The present species is the only one from the area for which significant biological and ecological data are available. Early accounts on the biology and ecology include MAGNUS (1960), LINSSENMAIR (1964, 1965, 1967). HUGHES (1973) has reported on the reproductive biology. SPAARGARDEN & ACHITUV (1977) included it into a physiological investigation on response to temperature stress in crustaceans. More recently ESHKY (1985) has presented an extensive study on the ecology, behaviour and physiology. Several aspects of the respiratory physiology were studied in subsequent smaller papers: AL WASSIA et al. (1988, 1989), BRIDGES (1986), ESHKY et al. (1988, 1990), MORRIS & BRIDGES (1985), MORRIS & TAYLOR (1988), WHITLEY et al. (1990).

Key to adult *Ocypode* ghost crabs of the Arabian shores

- | | | |
|---|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|
| 1 | No stridulating ridge on the inner surface of major cheliped palm | |
| | | <i>Ocypode cordimanus</i> |
| – | A stridulating ridge on the inner surface of major cheliped palm | 2 |
| 2 | Stridulating ridge composed of about 15 striae or less, each of those made up of granules. Tip of minor cheliped rounded | |
| | | <i>Ocypode rotundata</i> |
| – | Stridulating ridge composed of about 67 elements (striae and/or tubercles) or more (up to about 87). Tip of minor cheliped pointed | 3 |
| 3 | Eyestalks extended beyond cornea (stylophthalmous). Stridulating ridge exclusively composed of striae. Propodi of third pereopods naked | |
| | | <i>Ocypode saratan</i> |
| – | Eyestalks not extended beyond cornea. Stridulating ridge composed of tubercles which gradually intergrade into striae. Propodi of third pereopods with a row of bristles on upper border | |
| | | <i>Ocypode jousseaumei</i> |

Remark: The present key should only be used for adult specimens, hints for the identification of juveniles are given in the subsequent section.

Identification of juveniles (Figs 3, 6, 8, 10)

The identification of juvenile ghost crabs is difficult as some of the characters being used to distinguish adults are not present in young specimens. This applies specifically to the morphology of the eyestalks. The stylophthalmous processes beyond the cornea, characteristic of some species (*O. saratan* and *O. rotundata* in the area treated here) appear quite late in the individuals' development. These 'eyesticks', as they are often termed in carcinological literature, begin to protrude at a carapace breadth of about 23 mm in *O. rotundata* and about 22 mm in *O. saratan*, and grow continuously at every subsequent moult to the typical shape and size in adult specimens. The morphology of the orbital border and the external orbital corner is correlated with the stylophthalmism of the eyestalk. In juveniles without eyesticks the external half of the upper orbital border is concave and the exorbital tooth is evident. With the developing stylophthalmism the external half of the upper orbital border is more and more directed posterolaterally and the external orbital corner becomes rounded (*O. rotundata*) or shortly protruding (*O. saratan*). This means that the adult characters of the orbit can also not be used for recognising juvenile specimens and distinguishing them from other species of the genus, as previously pointed out by GEORGE &



Fig. 11: Distribution map for *Ocypode cordimanus* and *O. jousseaumei* in the Arabian area.

KNOTT (1965). The misidentifications of juvenile *O. saratan* as *O. ceratophthalma* in the past are due to confusions caused by the misinterpretation of juvenile characters.

The stridulating ridge on the inner face of the palm of the large chela develops quite early and is, therefore, the main character for identifying juveniles. It begins to appear in vestiges in *O. saratan* of 6.3 mm carapace breadth. Specimens of similar size could not be examined by us for *O. rotundata* and *O. jousseaumei*. Evident stridulating ridges were present in specimens of 15.8 mm carapace breadth in the former and 7.8 mm in the latter, so that they must develop at a similar size as in *O. saratan*. Thus, from about 6.5 mm on it is possible to distinguish these three species from *O. cordimanus*, which does not have a stridulating ridge at all. The length of the stridulating ridge allows juveniles of *O. jousseaumei* to be distinguished safely from the sympatric *O. saratan*. In the latter species the upper end of this feature reaches to the level of the dactyl midline while it runs much farther in *O. jousseaumei*. Juveniles of *O. saratan* can also be easily distinguished from those of *O. rotundata* by the much higher number of elements (about 50 striae) in the former versus only 10-11 distinct striae made up of granules in the latter. This difference might prove important when examining material from the easternmost coast of Yemen and westernmost coast of Oman where the two species could meet.

The arrangement of hairs on the propodi of the pereopods can differ considerably in juvenile *Ocypode* from that in the adults. Only in *O. jousseaumei* are there sparse hairs on the anterior faces of the propodi of the third pereopods. In *O. cordimanus* they are naked. In *O. saratan* and *O. rotundata* the distal ends bear characteristic short yellow bristles (also present on the second pereopod), which may in very small specimens spread over the whole joint. These last two species have only scattered sparse hairs along the midline of the anterior face of the second pereopods, while *O. jousseaumei* and *O. cordimanus* bear a distinct hair row in the same position. *O. cordimanus* bears an additional hair row (only distinct in juveniles) along the upper border of the same joint.



Fig. 12: Distribution map for *Ocypode rotundata* and *O. saratan* in the Arabian area.

In summary, the best character for distinguishing juveniles is the morphology of the stridulating crest. The setation of the propodi of the second and third pereopods also offers a number of clear features. Figures of the relevant parts are shown in order to facilitate the identification of young specimens.

Remarks on zoogeography (Figs 11-12)

The ghost crab fauna treated in this paper is confined to the Arabian shores, the whole of the Red Sea, the southern shores of the Gulf of Aden, and Pakistan. Within this area there is a differentiation between the Red Sea, Gulf of Aden (western part of the north coast) on one side and the NE Gulf of Aden, Gulf of Oman, Arabian Gulf and Western Pakistan on the other side. However, *O. saratan* and *O. rotundata* are so close to each other that the similarities are far more important than the differences. The very localised occurrence of *O. jousseaumei* is still unexplained. The only 'indifferent' widely ranging species is *O. cordimanus*, which however, seems to be rare in the area. This is in sharp contrast with the fact that this species belongs to the most common faunal elements of higher sandy dune areas behind all other tropical Indopacific beaches. The dominant and common species of the area are clearly *O. saratan* and *O. rotundata*, which replace *O. ceratophthalma* common on all other tropical beaches of the Indopacific.

In East Africa, south of Cape Hafun, another very characteristic faunal assemblage of *Ocypode*-species is found: the dominant species are *O. ceratophthalma* and *O. ryderi*, and *O. cordimanus* becomes much more common. Towards the south at the South African coast another species joins this assemblage: *O. madagascariensis* (Crosnier, 1965) originally described from Madagascar and then rediscovered in South Africa (see KENSLEY 1981). *O. pauliani* Crosnier, 1965, is confined to Madagascar and does not reach the African mainland. The characteristics of all these species have

been discussed by CROSNIER (1965) and SAKAI & TÜRKAY (1976). This assemblage is confined to East Africa and it mixes at the island of Socotra with the Arabian species, where *O. ryderi* coexists with *O. saratan*. The same applies to stretches of the NE Somalian coast near Cape Hafun and Bedei (see GUINOT 1962, VANNINI & VALMORI 1981). Unfortunately, no details are known concerning the relative dominances of the species. In fact, the overlapping areas seem to be fairly restricted.

Towards the east, the Arabian species assemblage meets the Indian faunal assemblage characterised by *O. brevicornis* H. Milne-Edwards, 1837 (= *O. platytarsis* auct.), *O. macrocera* H. Milne-Edwards, 1837, *O. ceratophthalma*, and *O. cordimanus*, the first two of which are confined to the Indian Peninsula and quite common there. Again, it is unclear if there is an overlap with the Arabian fauna, because there is little information on the ghost crab fauna of Pakistan and the Gujarat coast of India. According to HASHMI (1963) *O. ceratophthalma* and *O. cordimanus* occur in the Karachi area (Dongi Island, Manora Island and Buleji). TIRMIZI (1980) and TIRMIZI & KAZMI (1983) list both species in faunal lists of Pakistan Decapoda without reference to specific localities. For the time being it may be concluded that the Arabian species *O. rotundata* meets the two mentioned common Indopacific species in the Karachi area and along the northern Gujarat coast of India. CHHAPGAR (1956, 1957) recorded *O. rotundata* from Kutch and as far south as Okha. There is no information available on relative abundances, competition etc. which would allow for a better classification of the Pakistani coast.

ACKNOWLEDGEMENTS

We are thankful to the curators of all the museums mentioned in the introduction for lending material under their care and providing information on the samples. Besides this we thank M.D. Gallagher (Muscat, Oman) for providing ghost crabs from the coast of Oman. K. Sakai is grateful to the Alexander von Humboldt Stiftung (Bonn) for a grant allowing the start of a revision of the genus *Ocypode*. Part of the present work was funded by the 'Deutsche Forschungsgemeinschaft' (Bonn) (grant Tu 51/5-1 to M. Türkay) for which we are grateful. M. Apel worked on the Saudi Arabian Gulf coast during his participation in the project "Establishment of a Marine Habitat and Wildlife Sanctuary for the Gulf Region" co-funded by the Commission of the European Communities (Brussels, Belgium) and the National Commission for Wildlife Conservation and Development (Riyadh, Saudi Arabia). We are grateful to the Project manager, F. Krupp (Frankfurt a.M., Germany) for this opportunity and for his help during and after the project.

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Terrestrial Isopoda (Crustacea) from Yemen

Franco Ferrara and Stefano Taiti

Abstract: Sixteen species of terrestrial isopods are recorded from Yemen. Two genera (*Socotroniscus* and *Dioscoridillo*) and six species (*Socotroniscus sacciformis*, *Xeroniscus sulcatus*, *Periscyphis minor*, *Koweitoniscus vanharteni*, *Angaribia (?) lobata* and *Dioscoridillo melanoleucos*) are described as new. *Platyarthrus aiasensis*, *Agnara madagascariensis* and *Armadillidium vulgare* are newly recorded from Yemen; the first species represents a new record for the Arabian Peninsula. The total number of terrestrial isopod species known from Yemen is now 20, and from the whole Arabian Peninsula and surrounding islands is now 40.

متساويات الأرجل البرية (صنف القشريات) من اليمن

فرانكو فرارا وستفانو تاييتي

خلاصة: يحتوي البحث على تسجيل ١٦ نوعاً من متساويات الأرجل البرية من اليمن. وتم وصف الجنسين ، *Dioscoridillo* و *Socotroniscus*. بالإضافة إلى الأنواع الستة الجديدة للعلم : *Socotroniscus sacciformis* ، *Xeroniscus sulcatus* ، *Periscyphis minor* ، *Koweitoniscus vanharteni* ، *Angaribia (?) lobata* و *Dioscoridillo melanoleucos* كما تم تسجيل الانواع التالية لأول مرة من اليمن. *Platyarthrus aiasensis* ، *Agnara madagascariensis* ، *Armadillidium vulgare*. ويمثل النوع الاول تسجيلاً جديداً من شبه الجزيرة العربية. إن العدد الأجمالي الحالي لأنواع متساويات الأرجل البرية المعروفة من اليمن هو ٢٠، ومن شبه الجزيرة العربية والجزر المجاورة هو ٤٠.

INTRODUCTION

In recent years, our knowledge of the terrestrial isopods of Yemen, and of the Arabian Peninsula in general, has been considerably increased, thanks mostly to the collecting activity of Prof. W. Büttiker (Basle), M.D. Gallagher (Muscat) and W. Wranik (Rostock). Prior to their contributions, only eight species were known from the whole area, five of which were from Yemen (BARNARD 1941; GIORDANI SOIKA 1954; VANDEL 1975; KHEIRALLAH 1979 a, 1979 b; ATAUR-RAHIM 1982). At present 33 species are recorded, including 11 from Yemen (FERRARA & TAITI 1986, 1988, 1990; TAITI & FERRARA 1986, 1989, 1991; TAITI et al. in press).

When new areas and habitats are investigated, other, often new, species are usually discovered. This paper deals with material collected in various parts of Yemen and forwarded to us by the Senckenberg Museum, Frankfurt. It also includes some specimens from Socotra Island, for which there were no previous records of Oniscidea. Sixteen species (including six new ones) are listed here, but the collection includes at least another five or six species whose identification was not possible because they were only represented by single female specimens.

Material examined is deposited in the Senckenberg Museum, Frankfurt (SMF) and the Museo di Storia Naturale, Sezione di Zoologia 'La Specola' dell'Università, Florence (MZUF).

SYSTEMATIC ACCOUNT

Family *Platyarthridae*Genus *Platyarthrus* Brandt, 1833*Platyarthrus aiasensis* Legrand, 1953

Platyarthrus Schöbllii aiasensis Legrand, 1953. — Mém. Mus. natn. Hist. nat. Zool. 6 (3):145, Figs 1-2.

Material: Yemen: 21 ♀♀, Sana'a, VIII.1991, A. van Harten, SMF.

Remarks: This is the first record of the species for the Arabian Peninsula.

Distribution: Species with a W-Mediterranean-Atlantic distribution. It has also been introduced to Cape Town in South Africa (TAITI & FERRARA 1980), California, Texas and St. Barthelemy in the Caribbean (GARTHWAITE & TAITI 1989).

Family *Porcellionidae*Genus *Porcellio* Latreille, 1804*Porcellio yemenensis* Barnard, 1941

Porcellio yemenensis Barnard, 1941. — Exp. S-W Arabia: 57, Fig. 1.

Porcellio yemenensis. — Ferrara & Taiti 1986: 95, Figs 3, 17; Taiti & Ferrara 1989: 79; Kheirallah & Abboud 1989: 240, Fig. 1 B; Schmalfuss 1992: 9, Figs 11-15.

Material: Yemen: 1 ♂, 2 ♀♀, Jebel an Nabi Shu'ayb, 3660 m, 27.IV.1991, A. van Harten, SMF; 5 ♂♂, 7 ♀♀, 3 juvs, same locality, 11.III.1992, A. van Harten, SMF; 4 ♂♂, 10 ♀♀, 4 juvs, same locality, 16.X.1992, A. van Harten, SMF.

Distribution: Saudi Arabia and Yemen.

Genus *Porcellionides* Miers, 1877*Porcellionides pruinosus* (Brandt, 1833)

Porcellio pruinosus Brandt, 1833. — Bull. Soc. Imp. Nat. Moscou 6: 181.

Porcellionides pruinosus. — Barnard 1941: 59; Ferrara & Taiti 1986: 95, Fig. 17; Constantinou & Cloudsley-Thompson 1987: 205; Ferrara & Taiti 1988: 393; Taiti & Ferrara 1989: 79; Kheirallah & Abboud 1989: 239, Fig. 1 A; Taiti & Ferrara 1991: 217; Kheirallah 1991: 252.

Metoponorthus pruinosus. — Ataur-Rahim 1982: 248.

Material: Yemen: 1 ♂, 8 ♀♀, Sana'a, VIII.1991, A. van Harten, SMF; 1 ♀, same locality, II.1992, A. van Harten, SMF; 2 ♂♂, same locality, V.1992, A. van Harten, SMF; 1 ♂, 4 ♀♀, Sana'a to Mabar, near Thibar, 12.III.1992, A. van Harten, SMF; 1 ♂, 2 juvs, around Medinat Al Shirq, 7.III.1993, A. van Harten, SMF; 1 ♀, Al Kowd, IV.1993, A. van Harten, SMF.

Distribution: Cosmopolitan species of Mediterranean origin.

Family *Trachelipodidae*Genus *Agnara* Budde-Lund, 1908*Agnara madagascariensis* (Budde-Lund, 1885)

Metoponorthus Madagascariensis Budde-Lund, 1885. — Crust. Isop. terr.: 189.

Protracheoniscus inexpectatus. — Ferrara & Taiti 1986: 94, Figs 1-2, 17.

Agnara madagascariensis. — Taiti & Ferrara 1991: 217.

Material: Yemen: 2 ♂♂, 4 ♀♀, 7 juvs, Wadi Surdud, 28-29.XII.1991, A. van Harten, SMF; 1 ♂, 7 ♀♀, Aden, A. Allspach, SMF.

Remarks: First record for Yemen.

Distribution: Guinea Bissau, Senegal, Madagascar, Saudi Arabia, Yemen, Oman, southern China and Macao (?) (KWON & TAITI 1993).

Genus *Socotroniscus* n. gen.

Type species: *Socotroniscus sacciformis* n. sp.

Diagnosis: Animals unable to roll up into a ball. Back covered with distinct granulation and inconspicuous elongate scale-spines; no visible gland pores on pereonites; noduli laterales arranged as in Fig. 1 b. Cephalon without frontal and suprantennal lines; lateral lobes rounded, oblique. Posterior margins of pereonites 1 and 2 straight; epimera of pleonites 3-5 falciform, clearly protruding backwards. Telson triangular, short, not surpassing posterior margin of uropodal protopod. Antennule with some aesthetascs near apex of third segment. Antenna with first segment of flagellum much longer than second. Molar penicil of mandible consisting of a single plumose seta. Maxillule with outer branch bearing 4 + 6 teeth, all simple; inner branch without posterior point. Endite of maxilliped glabrous. All pleopodal exopods with peculiar covered lungs, i.e. without perispiracular area and with a single narrow spiracle opening in a sack-like atrium, from which short respiratory tubules branch off. Uropod with protopod having a Λ -shaped incision on outer margin.

Etymology: The name of the genus refers to Socotra plus the suffix -oniscus. Gender masculine.

Remarks: *Socotroniscus* belongs to the group of genera characterised by monospiracular covered lungs on all pleopodal exopods and by a straight posterior margin of pereonite 1: *Agnara* Budde-Lund, 1908, *Hemilepistus* Budde-Lund, 1885 (and its subgenus *Desertellio* Verhoeff, 1930), *Protracheoniscus* Verhoeff, 1917, *Desertoniscus* Verhoeff, 1930, *Mongoloniscus* Verhoeff, 1930, *Hemilepistoides* Borutzky, 1945, *Fossoniscus* Strouhal, 1965, *Tadzhikoniscus* Borutzky, 1976 and *Orthometopon* Verhoeff, 1917 (sensu SCHMALFUSS 1993).

In the absence of a frontal line, the genus corresponds to *Hemilepistus* s. str., but it differs from all the other genera. It is distinguished from *Hemilepistus* s. l. by the absence of big conical tubercles on the anterior part of the body and the presence of large lateral lobes on the cephalon (reduced in *Hemilepistus*). It differs from *Agnara*, *Hemilepistus* s. str., *Protracheoniscus*, *Desertoniscus*, *Mongoloniscus* and *Orthometopon* (we have not examined species of the other genera) in the structure of the pleopodal lungs; from *Fossoniscus* and *Desertoniscus* in the position of the noduli laterales (see STROUHAL 1965: Fig. 7 and BORUTZKY 1978: Plate 1, Fig. 3). While the genus appears well characterised at the moment, it is impossible to give a satisfactory account of its affinities, even though it appears isolated within the group: indeed we do not know of any Trachelipodidae or Porcellionidae, nor of any other Oniscidea, with this type of lungs. However, we must point out that we have not examined all the genera nor can we confirm the accuracy of the illustrations of the structure of the lungs in the literature.

Socotroniscus sacciformis n. sp. (Figs 1, 2)

Holotype: ♂, Yemen, Socotra, Muomi, 15.IV.1993, A. van Harten, SMF. — Paratypes: 3 ♂♂, 3 ♀♀, 3 juvs, same data, SMF; 1 ♂, 1 ♀, same data, MZUF.

Diagnosis: A species characterised by a granulated dorsum, a cephalon with two pairs of frontal paramedian tubercles, straight posterior margin of pereonite 1, short triangular telson,

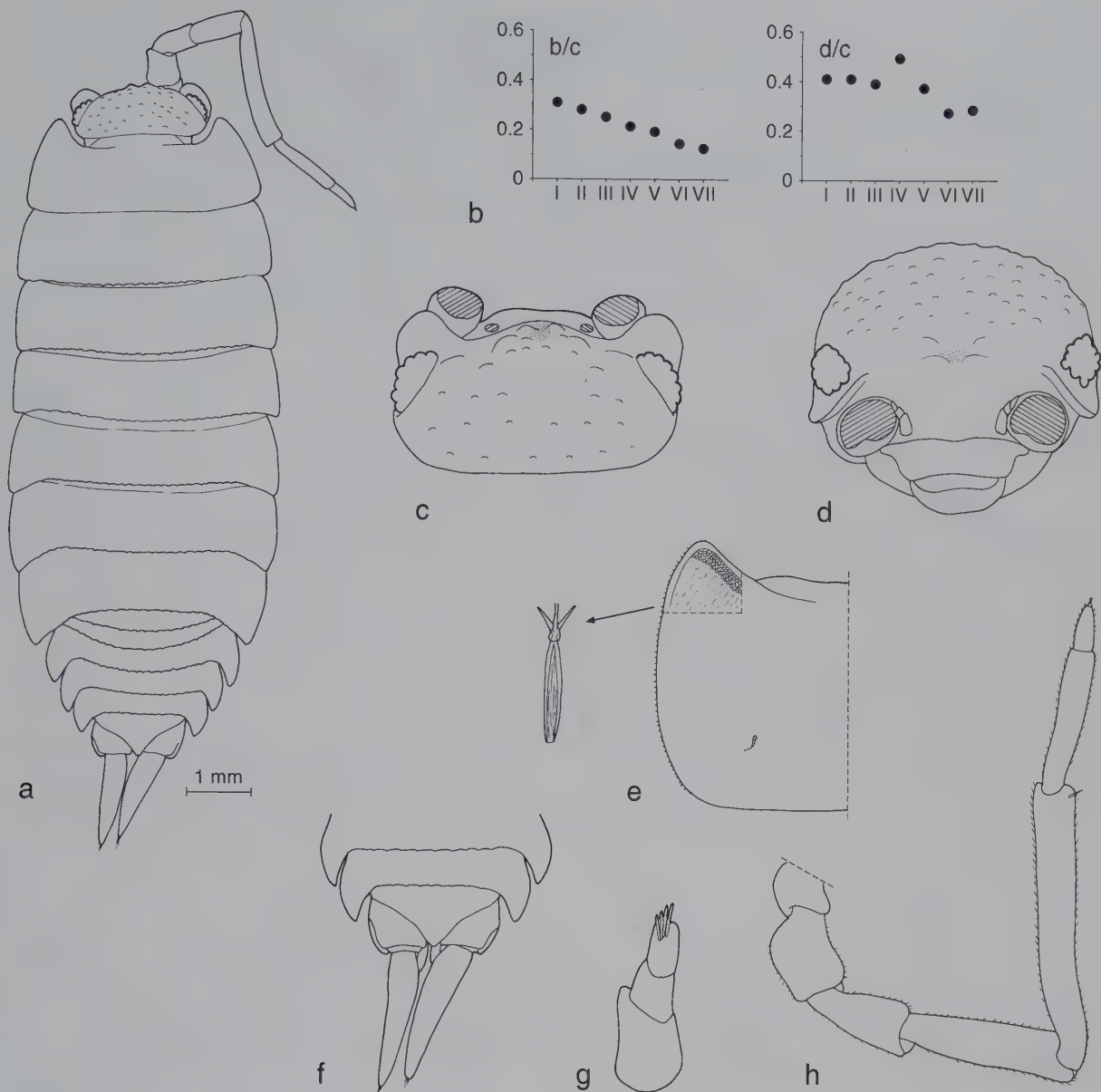


Fig. 1: *Socotroniscus sacciformis* n. gen., n. sp., ♂: a, adult specimen in dorsal view; b, co-ordinates of noduli laterales; c, cephalon in dorsal view; d, cephalon in frontal view; e, left side of pereonite 1 in dorsal view; f, pleonites 4 and 5, telson and uropods; g, antennule; h, antenna.

sacciform pleopodal lungs, elongated uropodal exopods, male pereopods 1-3 with a brush of spines on merus and carpus, and exopod of male pleopod 1 ovoidal.

Description: ♂, 12 × 4 mm; ♀, 12.5 × 5 mm. Cephalon, pereon, antennae and uropods yellowish suffused with brown; tergites of pleon dark brown, pale epimera. Dorsum with numerous small granules, two pairs of paramedian tubercles in frontal part of cephalon; cuticle covered with small semicircular scales and elongated scale-spines. Eye with 15-16 ommatidia. Cephalon with frontal lateral lobes slightly protruding forwards compared with profrons. Telson about twice as wide as long, with slightly concave sides. Antennule with second and third article subequal in length, shorter than first; apex with a tuft of four aesthetascs. Antenna reaching posterior margin

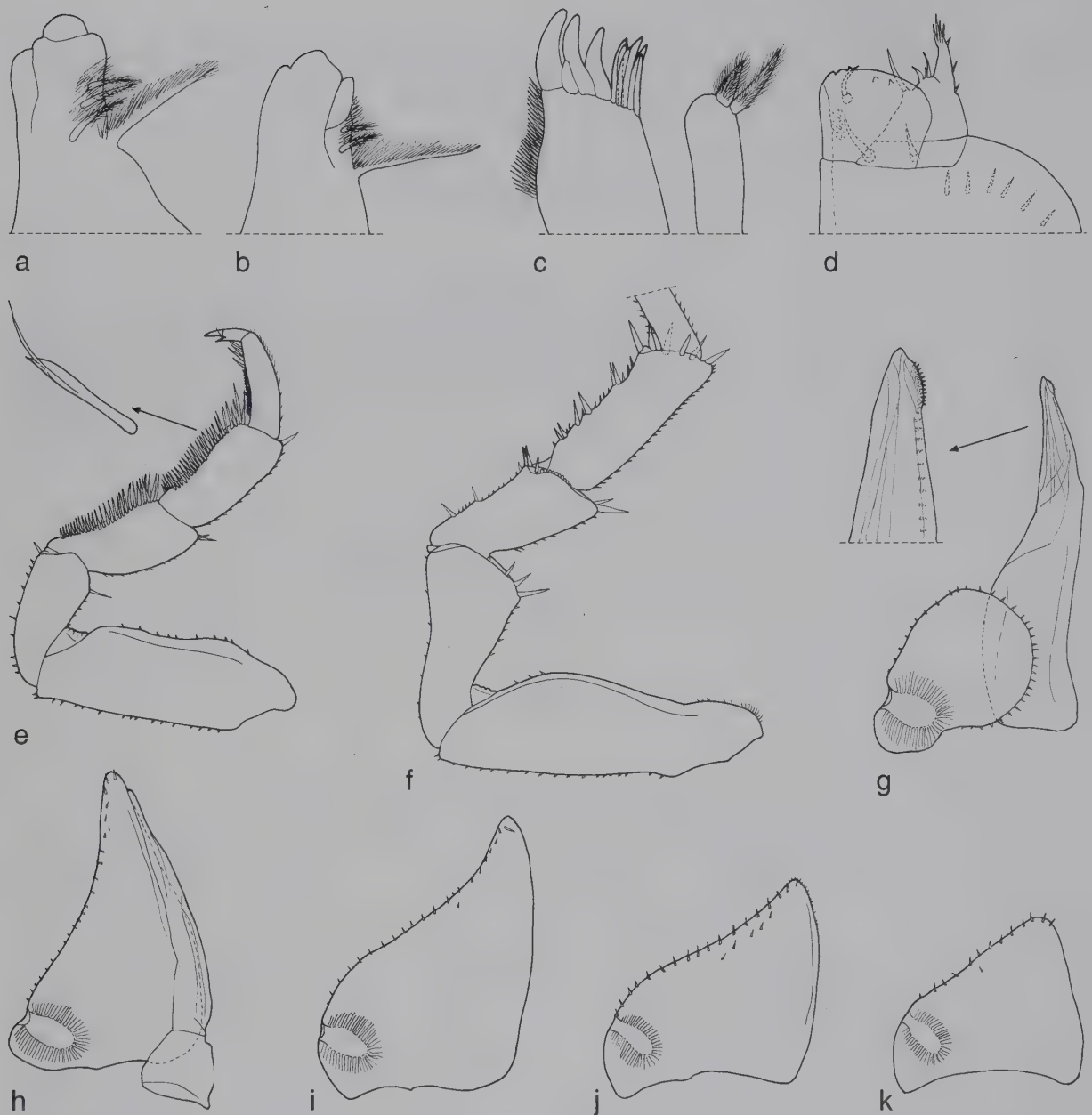


Fig. 2: *Socotroniscus sacciformis* n. gen., n. sp., ♂: a, left mandible; b, right mandible; c, maxillule; d, maxilliped; e, pereopod 1; f, pereopod 7; g, pleopod 1; h, pleopod 2; i, exopod of pleopod 3; j, exopod of pleopod 4; k, exopod of pleopod 5.

of pereonite 3; fifth article of peduncle longer than flagellum; first flagellar article more than three times as long as second. Uropod with exopod elongated, more than twice as long as protopod.

Male: Pereopods 1-3 with a brush of pointed spines on merus and carpus. Ischium of pereopod 7 with slightly concave sternal margin. Exopod of pleopod 1 ovoidal, with external margin bearing short spines; endopod slightly swollen subapically, with short spines. Endopod of pleopod 2 shorter than exopod. Exopod of pleopods 3-5 as in Fig. 2 i-k.

Etymology: From Latin *saccus* = sack and *formis* = in the form of. The name refers to the sack-like shape of the pleopodal lungs.

Family Armadillidiidae

Genus *Armadillidium* Brandt, 1833*Armadillidium vulgare* (Latreille, 1804)

Armadillo vulgaris Latreille, 1804. — Hist. nat. gén. part. Crust. Ins. 7: 48.

Armadillidium vulgare. — Taiti & Ferrara 1991: 218.

Material: Yemen: 5 ♀♀, Sana'a, Malaise trap, II.1992, A. van Harten, SMF.

Remarks: First record for Yemen.

Distribution: Cosmopolitan species of Mediterranean origin.

Family Eubelidae

Genus *Xeroniscus* Ferrara & Taiti, 1990*Xeroniscus bicoloratus* (Barnard, 1941)

Periscyphis bicoloratus Barnard, 1941. — Exp. S-W Arabia: 65.

Periscyphis bicoloratus. — Ferrara & Taiti 1986: 97, Figs 8, 17.

Xeroniscus bicoloratus. — Ferrara & Taiti 1990: 93, Figs 1, 5.

Material: Yemen: 1 ♂, 1 ♀, Wadi Surdud, 28-29.XII.1991, A. van Harten, SMF.

Distribution: Yemen.

Xeroniscus angusticauda Ferrara & Taiti, 1990

Xeroniscus angusticauda Ferrara & Taiti, 1990. — Trop. Zool. 3: 98, Figs 1, 8, 9.

Material: Yemen: 1 ♂, Wadi Bana, 26.X.1992, A. van Harten, SMF.

Distribution: Yemen.

Xeroniscus sulcatus n. sp. (Fig. 3)

Holotype: ♂, Yemen, Al Mahwit, 28-29.IV.1991, A. van Harten, SMF.

Diagnosis: A species of *Xeroniscus* characterised by the presence of a short dorsal groove (sulcus arcuatus) on the anterior part of pereonite 1, uropodal protopod with postero-medial corner very long and acute, merus of male pereopod 7 with a protruding rounded lobe on tergal margin.

Description: 3 × 1 mm. Cephalon and pleon dark brown, pereon pale with some brown spots, telson and uropods pale. Dorsum with some pointed scale-spines. Eye with about ten ommatidia. Cephalon with profrons clearly convex in the middle; lateral lobes small, triangular; interocular line not visible. Pereonite 1 with a short sulcus arcuatus on the anterior part parallel to the lateral margin; posterior margin slightly concave at sides; posterior corners rounded. Posterior margin of pereonite 7 regularly concave. Telson slightly wider than long, with a narrow triangular distal part, rounded apex. Antennae missing. Uropodal protopod with postero-medial corner very long, acute, medially directed and reaching tip of telson. Pereopod 1 with a sparse brush of short, pointed spines on carpus. Ischium of pereopod 7 with straight sternal margin; merus with a rounded protruding lobe on tergal margin. Exopod of pleopod 1 subquadrangular, with some short spines on posterior margin; endopod with straight distal part, triangular apex. Pleopod 2 and exopod of pleopods 3-5 as in Fig. 3 i-l.

Etymology: from Latin *sulcatus* = having a groove. The name refers to the sulcus arcuatus on the dorsal surface of pereonite 1.



Fig. 3: *Xeroniscus sulcatus* n. sp., holotype, ♂: a, cephalon in frontal view; b, cephalon in dorsal view; c, cephalon in lateral view; d, left side of pereonite 1 in dorsal view; e, pereonite 7, pleon, telson and uropods; f, pereopod 1; g, pereopod 7; h, pleopod 1; i, pleopod 2; j, exopod of pleopod 3; k, exopod of pleopod 4; l, exopod of pleopod 5.

Remarks: Despite the presence of a sulcus arcuatus on pereonite 1, a character absent in all the other species of *Xeroniscus*, we ascribe the new species to this genus because all the main characters, in particular the structure of the cephalon, buccal pieces, pleopodal lungs and uropods, correspond perfectly to those found in the other species of the genus. Moreover, in the closely related genus *Periscyphis*, we find species with a well-developed sulcus arcuatus (e.g. *P. arabicus*) together with species in which it is present only in the anterior part of pereonite 1 (e.g. *P. civilis* Budde-Lund, 1908) or is absent (*P. vittatus*).

Genus *Periscyphis* Gerstaecker, 1873*Periscyphis vittatus* Omer-Cooper, 1926

Periscyphis vittatus Omer-Cooper, 1926. — Proc. Zool. Soc. Lond. 24: 366, Figs 23-27.

Periscyphis vittatus. — Ferrara & Taiti 1986: 96, Figs 6, 17; Ferrara & Taiti 1988: 395; Taiti & Ferrara 1989: 79; Kheirallah & Abboud 1989: 242, Fig. 1 C; Taiti & Ferrara 1991: 218.

Material: Yemen: 1 ♂, Aden, 17-18.XII.1991, A. van Harten, SMF; 1 ♀, Wadi Surdud, 28-29.XII.1991, A. van Harten, SMF.

Distribution: Eritrea, Djibouti, Somalia, Saudi Arabia, United Arab Emirates, Oman, Yemen and Mozambique (introduced?).

Periscyphis arabicus Barnard, 1941

Periscyphis granai var. *arabicus* Barnard, 1941 (partim). — Exp. S-W Arabia: 59, Fig. 2 a-g, i.

Periscyphis arabicus. — Ferrara & Taiti 1986: 97, Figs 10, 17; Taiti & Ferrara 1989: 80; Kheirallah & Abboud 1989: 242, Fig. 1 E.

Material: Yemen: 1 ♂, Sana'a, VIII.1991, A. van Harten, SMF; 3 ♂♂, 4 ♀♀, near Hajjah, 15.V.1992, A. van Harten, SMF.

Distribution: Saudi Arabia and Yemen.

Periscyphis barnardi Ferrara & Taiti, 1986

Periscyphis granai var. *arabicus* Barnard, 1941 (partim). — Exp. S-W Arabia: 59, Fig. 2 h.

Periscyphis barnardi Ferrara & Taiti, 1986: 98, Figs 11, 17. — Kheirallah & Abboud 1989: 243, Fig. 1 F; Taiti & Ferrara 1991: 219.

Material: Yemen: 2 ♀♀, Wadi Lahimah (Al Mahwit), 16.III.1992, A. van Harten, SMF; 1 ♂, Al Mudammer (Bait-al-Faqlh), 15.II.1992, M. Mahyoub, SMF; 2 ♂♂, 1 ♀, Al Kowd, Malaise trap, IV.1993, A. van Harten, SMF.

Distribution: Yemen.

Periscyphis minor n. sp. (Fig. 4)

Holotype: ♂, Yemen, Sa'dah, 13.VIII.1991, A. van Harten, SMF. — Paratypes: 2 ♂♂, 2 ♀♀, 1 juv., same data, SMF; 1 ♂, 1 ♀, same data, MZUF.

Diagnosis: A species of *Periscyphis* of the *granai*-group, characterised by the small size, a continuous frontal margin on cephalon, short distal part of telson, male pereopods with verrucae on sternal margin of ischium, short and enlarged merus and carpus of the male pereopod 7.

Description: ♂, 8 × 3 mm; ♀, 7 × 3 mm. Brown with several pale areas, lateral margin of body colourless; dark antennae, pale uropods. Dorsum with inconspicuous pointed scale-spines. Eye with 19-20 ommatidia. Cephalon with a continuous frontal margin, lateral lobes large, rounded; profrons slightly bulbous in the middle; no trace of interocular line on vertex. Pereonite 1 with lateral thickening and sulcus arcuatus well developed, disappearing near the posterior corner; lateral margin without depression, posterior corner rounded. Telson distinctly wider than long, distal part short, triangular, rounded apex. Antenna with first article of flagellum shorter than second. Uropodal protopod with an indentation on the posterior margin in which the small (almost as wide as long) exopod is inserted; endopod not visible in dorsal view.

Male: Ischium of all pereopods with verrucae on sternal margin. Carpus and merus of pereopods 1-3 with brushes of characteristic spines (see Fig. 4 g). Ischium of pereopod 7 much more slender than merus and carpus, sternal margin slightly sinuous with two small verrucae in the proximal half, caudal surface with a group of six short strong spines on distal margin; merus and carpus short, enlarged (about 1.3 times longer than wide); merus with sternal margin equipped with a group of four short spines at the base, tergal margin with a conspicuous rounded

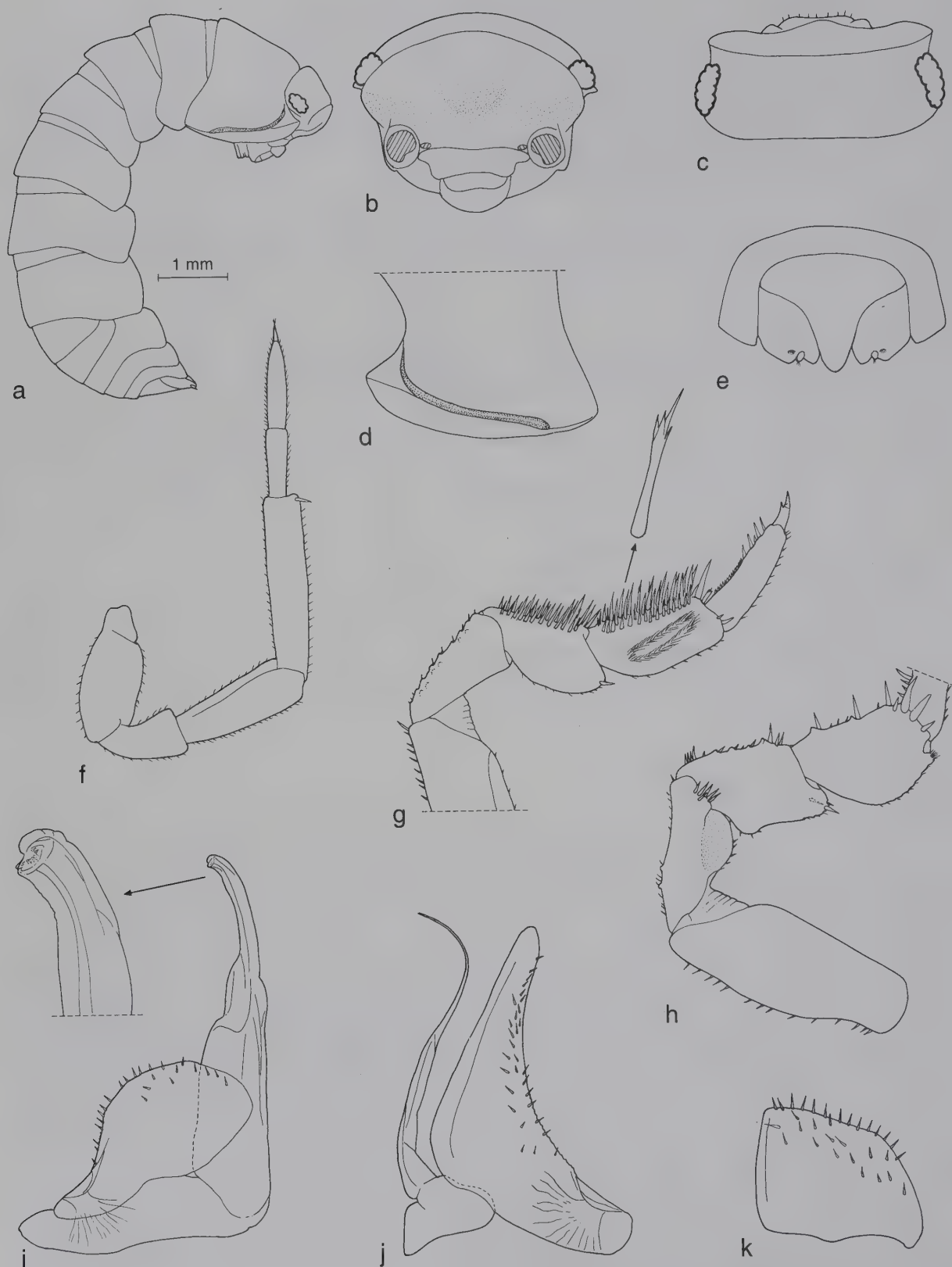


Fig. 4: *Periscyphis minor* n. sp., ♂: a, adult specimen in lateral view; b, cephalon in frontal view; c, cephalon in dorsal view; d, left side of pereonite 1 in dorsal view; e, pleonite 5, telson and uropods; f, antenna; g, pereopod 1; h, pereopod 7; i, pleopod 1; j, pleopod 2; k, exopod of pleopod 5.

protuberance at the base; carpus with tergal margin strongly arched and a small setose lobe distally, caudal surface with two big distal spines. Exopod of pleopod 1 subtriangular, posterior margin regularly rounded and equipped with short spines; endopod with distal part bent outwards, apical part with a short triangular process on the external margin. Pleopod 2 and exopod of pleopod 5 as in Fig. 4 j, k.

Etymology: From Latin minor = minor. The name refers to the comparatively small size of this species within the group.

Remarks: The new species belongs to the *P. granai*-group, and in particular it is close to the species with a continuous frontal margin: *P. granai* Arcangeli, 1929 and *P. latissimus* Omer-Cooper, 1926 from Eritrea, *P. arabicus* and *P. barnardi* from the southern part of the Arabian Peninsula and *P. omanensis* Taiti & Ferrara, 1991 from Oman. It is readily distinguished from *P. granai* and *P. barnardi* principally by the merus of the male pereopod 7 being short, enlarged and lacking a long process on the distal margin; from *P. latissimus* by the structure of pereonite 1, with a conspicuous lateral thickening and sulcus arcuatus disappearing near the posterior corner, whereas they are reduced and apparent only in the anterior part of the segment in *P. latissimus*. It differs from *P. arabicus* in the lack of a depression on the lateral margin of pereonite 1, the shape of the telson, the presence of verrucae on the ischium of the male pereopods, and from this species and *P. omanensis* by the shape of the male pereopod 7 (compare Fig. 4 h with Fig. 10 f, g in FERRARA & TAITI 1986 for *P. arabicus*, and with Fig. 5 g, h in TAITI & FERRARA 1991 for *P. omanensis*).

Genus *Koweitoniscus* Vandel, 1975

Koweitoniscus vanharteni n. sp. (Fig. 5)

Holotype: ♂, Yemen, Wadi Surdud, 28-29.XII.1991, A. van Harten, SMF. — **Paratypes:** 4 ♂♂, 3 ♀♀, same data, SMF; 1 ♂, 1 ♀, same data, MZUE.

Diagnosis: A species of *Koweitoniscus* characterised by the cephalon with a continuous frontal margin, male pereopod 7 with carpus strongly enlarged and with a triangular process on the distal margin.

Description: ♂, 8 × 3.5 mm; ♀, 9 × 4 mm. Light brown with pale areas and a dark stripe at the posterior margin of the pereonites; antennae dark, uropods pale. Back with inconspicuous pointed scale-spines. Eye with 18 ommatidia. Cephalon with a continuous frontal margin, profrons slightly bulbous in the middle; lateral lobes slightly protruding laterally. Pereonite 1 with lateral margin thickened, sulcus arcuatus deep and wide, posterior margin straight, outer lobe of schisma rounded, slightly protruding compared to inner one. Epimera of pereonites 2 and 3 with transverse thickenings ventrally. Telson slightly wider than long, with a triangular distal part, and broadly rounded apex. Antenna with flagellar articles subequal in length. Maxillule with outer branch bearing simple teeth; inner branch with two thin penicils. Exopod of pleopods 1 and 2 with *Periscyphis*-type lungs. Uropodal protopod slightly longer than wide, with posterior margin incised; small exopods.

Male: Pereopods 1-3 with a brush of pointed spines on carpus and, reduced, on merus; ischium with some verrucae on sternal margin. Ischium of pereopod 7 with sternal margin sinuous, carpus strongly enlarged with tergal margin distinctly arched; a triangular process on distal margin of caudal surface. Exopod of pleopod 1 subtriangular with short spines along the posterior margin; endopod with rounded apex and a subapical spiny process. Pleopod 2 and exopod of pleopod 5 as in Fig. 5 k, l.

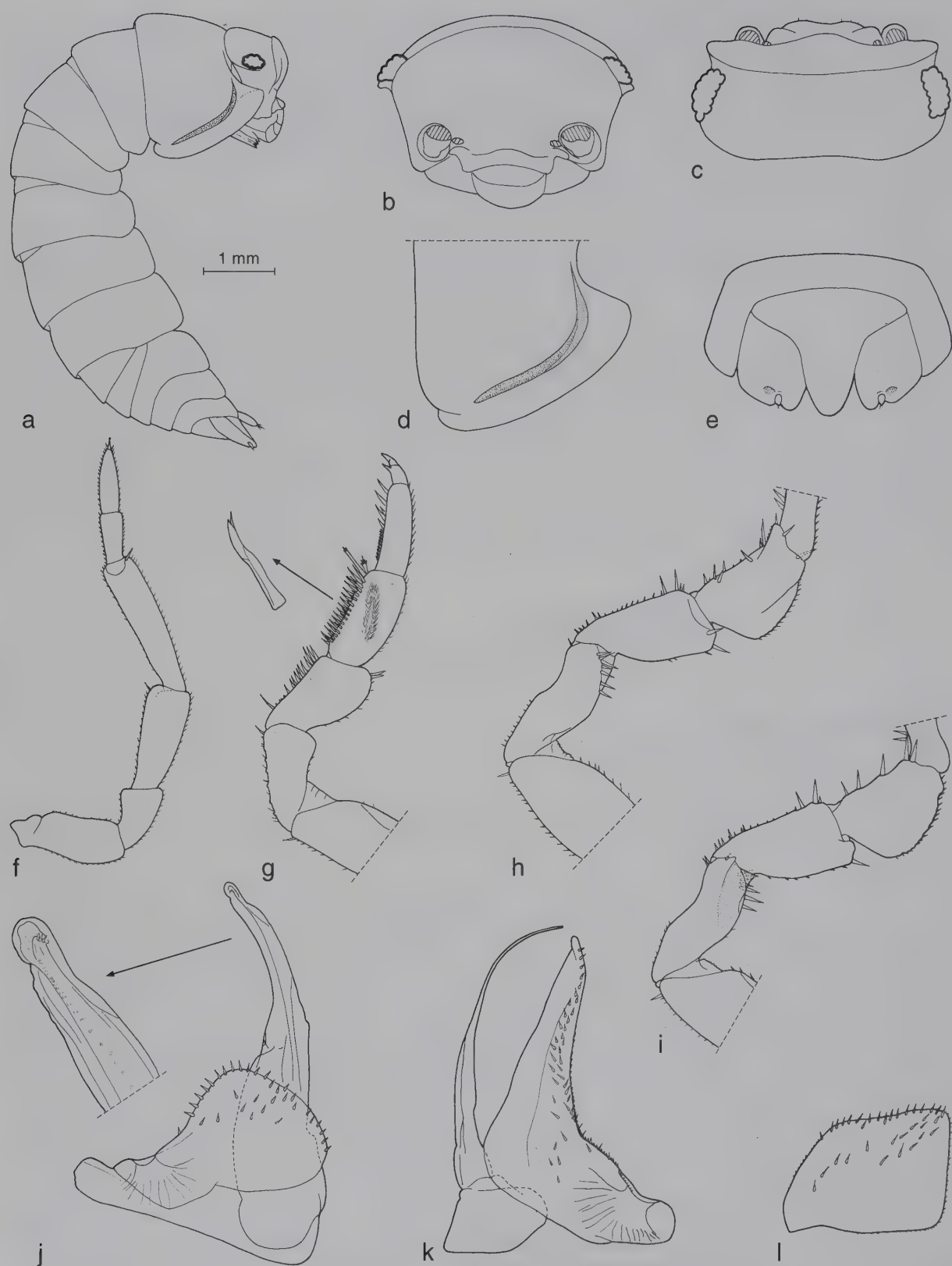


Fig. 5: *Koweitoniscus vanharteni* n. sp., ♂: a, adult specimen in lateral view; b, cephalon in frontal view; c, cephalon in dorsal view; d, right side of pereonite 1 in dorsal view; e, pleonite 5, telson and uropods; f, antenna; g, pereopod 1; h, caudal surface of pereopod 7; i, rostral surface of pereopod 7; j, pleopod 1; k, pleopod 2; l, exopod of pleopod 5.

Etymology: The new species is named after Mr. A. van Harten, who collected the specimens.

Remarks: The genus *Koweitoniscus* includes only two species, *K. tamei* (Omer-Cooper, 1923) and *K. rostratus* Ferrara & Taiti, 1986. The new species is very similar to *K. rostratus*, having a cephalon with a continuous frontal margin, uropodal protopod with posterior margin indented and carpus of the male pereopod 7 with a distal triangular process. It differs in the distal part of the telson being comparatively shorter and with rounded instead of narrowly rounded apex, the merus of the male pereopod 7 lacking a rounded lobe on the rostral surface and the carpus being strongly enlarged with a shorter distal process (compare Fig. 5 h, i with Fig. 16 f, g in FERRARA & TAITI 1986).

In the description of *K. rostratus*, FERRARA & TAITI (1986: 101) pointed out that the ascription of that species to the genus *Koweitoniscus* was preliminary, due to the differences from the type species (*K. tamei*) in the cephalic and uropodal structures. However, these characters are rather variable within the Eubelidae (e.g. in *Periscyphus* and *Microcercus*, certainly monophyletic taxa) and their importance at the generic level is still not clear. Since *K. vanharteni* is morphologically so similar to *K. rostratus*, the same doubt is valid also for this species.

Genus *Angaribia* Barnard, 1932

Angaribia (?) *lobata* n. sp. (Figs 6-7)

Holotype: ♂, Yemen, Jebel an Nabi Shu'ayb, 16.X.1992, A. van Harten, SMF. — **Paratypes:** 1 ♀, same data, SMF; 2 ♀♀, same locality, 3660 m, 11.III.1992, A. van Harten, SMF; 1 ♂, 1 ♀, same data, MZUF.

Diagnosis: A species of *Angaribia* characterised by a cephalon with a bulbous protuberance in the middle of the profrons, a telson with a long and narrow distal part and the male pereopod 7 with lobes on ischium and merus.

Description: ♂, 7 × 2.5 mm; ♀, 10 × 4.5 mm. Dark brown with small pale muscle spots; antennae and uropods dark brown. Very convex body with vertical epimera. Dorsum with inconspicuous pointed scale-spines. Eye with 18-19 ommatidia. Cephalon with large rounded lateral lobes, profrons with a conspicuous bulbous protrusion in the middle; interocular line distinctly visible at sides. Pereonite 1 with lateral thickening almost reaching posterior corner; lateral margin with a depression on posterior third; sulcus arcuatus very deep, medially delimited by a distinct ridge; posterior margin concave; posterior corner rounded, not cleft; ventral surface of lateral parts swollen in the anterior two-thirds, corresponding to the sulcus arcuatus, but with no trace of lobes or teeth. Epimera of pereonite 2 and, to a lesser extent, of pereonite 3 with a transverse swelling ventrally. Telson with narrow triangular distal part, twice as long as basal, narrowly rounded apex. Antenna with second flagellar article slightly longer than first. Molar penicil of mandible semi-dichotomised. Maxillule with inner branch bearing two penicils and no posterior point; outer branch with 4 + 5 teeth, all simple. Endite of maxilliped with two small denticles at apex. All pleopodal exopods with monospiracular, tubuliform covered lungs. Uropod with protopod rectangular, twice as long as wide in dorsal view, posterior margin with an indentation in the middle in which the small exopod is inserted.

Male: Carpus of pereopods 1-3 with a sparse brush of pointed spines. Ischium of pereopod 7 with a rectangular protrusion on sternal margin; merus with a conspicuous lamellar lobe on tergal margin. Exopod of pleopod 1 about three times wider than long, without posterior point; endopod with pointed apex, slightly recurved inward. Pleopod 2 and exopod of pleopods 3-5 as in Fig. 7 d-g.

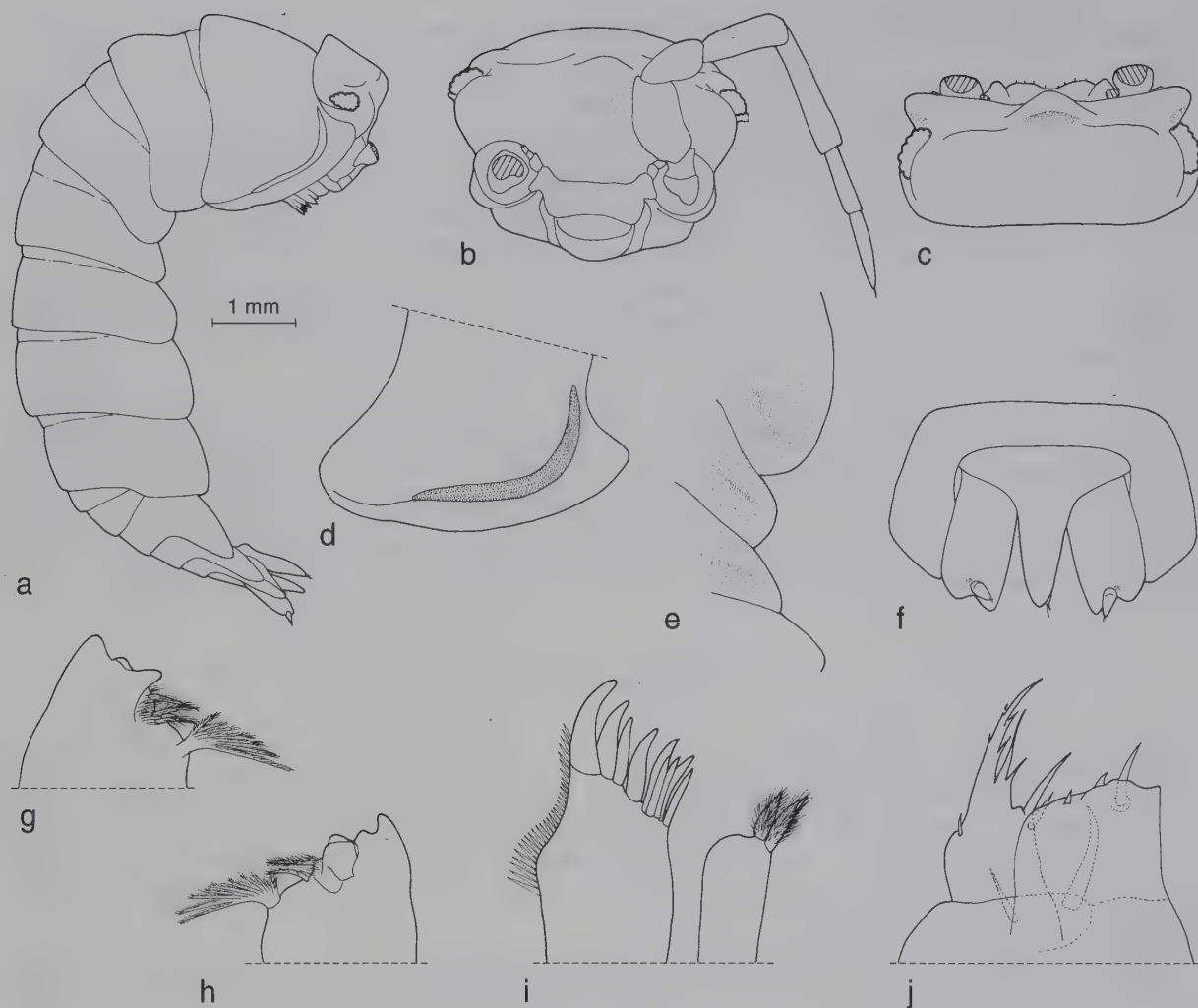


Fig. 6: *Angaribia* (?) *lobata* n. sp., ♂: a, adult specimen in lateral view; b, cephalon in frontal view; c, cephalon in dorsal view; d, right side of pereonite 1 in dorsal view; e, left side of pereonites 1-3 in ventral view; f, pleonite 5, telson and uropods; g, left mandible; h, right mandible; i, maxillule; j, maxilliped.

Etymology: From Latin *lobatus* = having a lobe. The name refers to the lobe on the merus of the male pereopod 7.

Remarks: This species is only tentatively included in the genus *Angaribia*: it fits the diagnosis of this genus in all major characters except that the inner teeth of the outer branch of the maxillule are all simple, while in *Angaribia* some of them are apically trifid. Since this character has rarely been used in the systematics of the Eubelidae, we are not able to evaluate its importance at the moment. On the other hand, the structure of the buccal pieces is considered to be of high taxonomic value in some families (e.g. Philosciidae) but not in others (e.g. Armadillidae). Other doubts arise from a comparison of the structure of the pleopodal lungs of exopods 3-5: in the new species they are narrow and long with the respiratory tubules branching off near the insertion of the appendage (as in *Xeroniscus*), while they have a short atrium and conspicuous respiratory tree in the other species of *Angaribia*. Moreover, there is a wide distributional gap between the new species and the other species in the genus: *A. kunenensis* (Barnard, 1924) from Angola and

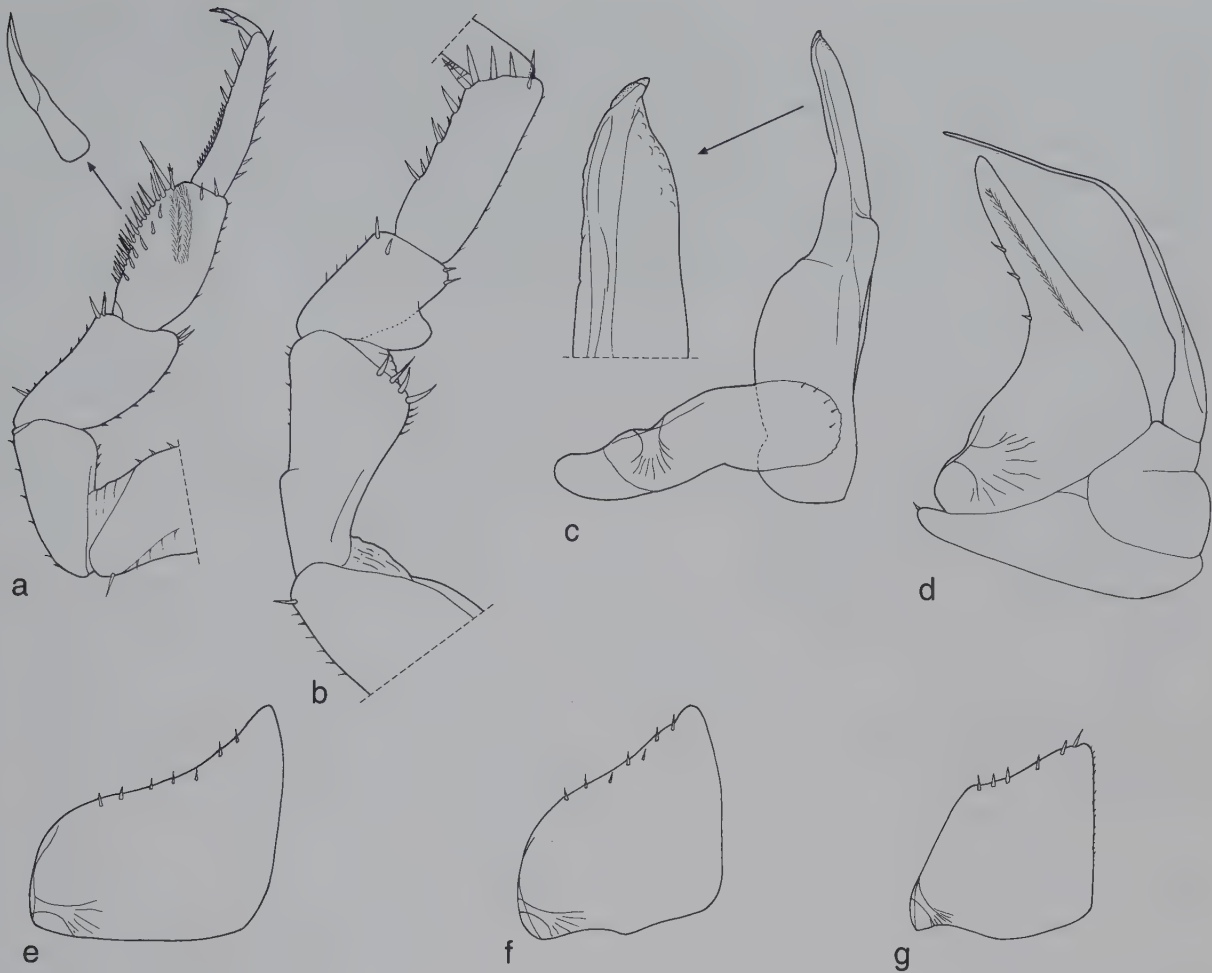


Fig. 7: *Angaribia* (?) *lobata* n. sp., ♂: a, pereopod 1; b, pereopod 7; c, pleopod 1; d, pleopod 2; e, exopod of pleopod 3; f, exopod of pleopod 4; g, exopod of pleopod 5.

Namibia and *A. flavicauda* Taiti & Ferrara, 1987 from Malawi. It is possible that the species from Yemen belongs to a genus distinct from *Angaribia*. However, considering the still fragmentary knowledge of both the genus and the family, and the lack of definite distinctive characters, we prefer not to establish a new genus.

The new species is well characterised principally by the shape of cephalon and telson and the modifications of the male pereopod 7.

Genus *Dioscoridillo* n. gen.

Type species: *Dioscoridillo melanoleucos* n. sp.

Diagnosis: Animals able to roll up into a ball; vertical epimera. Dorsum smooth. Cephalon with frontal margin which at the sides is not continuous with the lateral lobes. Pereonite 1 with a conspicuous, externally grooved, lateral thickening; sulcus arcuatus deep and narrow; posterior

corner with a schisma; outer lobe of schisma narrowly rounded, distinctly protruding backwards in comparison with the inner one. Epimera of pereonites 2 and 3 ventrally with transverse rounded lobes. Telson reaching posterior margin of uropodal protopod, with distal part triangular. Antennal flagellum of two articles. Maxillule with inner branch bearing two penicils; outer branch with $4 + 1 + 6$ teeth, some of them with inconspicuous accessory points. All pleopodal exopods with *Somaloniscus*-type covered lungs (FERRARA et al. 1991). Uropodal protopod lamellar with an indentation on the middle of the posterior margin, in which the exopod is inserted.

Etymology: From the ancient Greek and Latin name of Socotra: Dioscorides plus the suffix -illo. Gender masculine.

Remarks: The new genus belongs to the group of eubelid genera characterised by the presence of a lateral thickening, sulcus arcuatus and schisma on pereonite 1, antennal flagellum of two articles, inner branch of maxillule with two penicils, and five pairs of *Somaloniscus*-type lungs. This group includes only two genera: *Microcercus* Budde-Lund, 1910 and *Somaloniscus* n. gen. The latter genus was instituted by FERRARA & TAITI (1979: 162) to accommodate some species from Somalia but, since the authors did not choose a type species for *Somaloniscus*, this name is unavailable according to Article 13 b of the International Code of Zoological Nomenclature (International Commission on Zoological Nomenclature 1985). In order to revalidate the name *Somaloniscus*, we select here *Microcercus taramassoi* Arcangeli, 1933 as the type species of the genus.

Dioscoridillo is readily distinguished from *Somaloniscus* by the lack of a frontal lamina protruding above the vertex, epimera of pereonites 2 and 3 ventrally with rounded lobes instead of triangular teeth, telson triangular instead of hour-glass-shaped and by the structure of the uropods: the protopod is flattened with the medial part covered by the telson, and the exopod is inserted in an indentation in the middle of the posterior margin of the protopod, while in *Somaloniscus* (and *Microcercus*) the protopod is swollen with a grooved medial part where the lateral part of the telson is inserted, the exopod is reduced and inserted subdorsally near the postero-medial corner of the protopod. It differs from *Microcercus*, besides in the structure of the uropods, by the presence of a groove along the lateral thickening of pereonite 1, the outer lobe of the schisma narrowly rounded and distinctly protruding backwards compared to the inner one (in all the species of *Microcercus* it is widely rounded and not protruding backwards).

Dioscoridillo melanoleucos n. sp. (Fig. 8)

Holotype: ♀, Yemen, Socotra, Nogeed, 16.IV.1993, A. van Harten, SMF. — **Paratypes:** 1 ♀, same data, SMF; 1 ♀, same data, MZUF.

Diagnosis: A species characterised by the large size, by pereonite 1 having the lateral thickening externally grooved, by the outer lobe of the schisma being narrowly rounded and distinctly protruding backwards compared to the inner one, by the telson having a triangular distal part and rounded apex, and by the frail antenna.

Description: 16×7.5 mm. Cephalon, pereon, pleon and telson black, lateral margin of body white, a large white median spot on the posterior margin of cephalon and pereonites; antennae and uropods pale. Eye with 22-23 ommatidia. Cephalon with profrons slightly bulbous in the middle; lateral lobes broadly rounded. Pereonite 1 with posterior margin slightly concave at sides. Telson with distal part narrow, triangular, rounded apex. Antenna frail, reaching the middle of pereonite 2; first flagellar article longer than second.

Male: unknown.

Etymology: From Greek mélas = black plus leukós = white. The name refers to the black and white colour of the specimens.

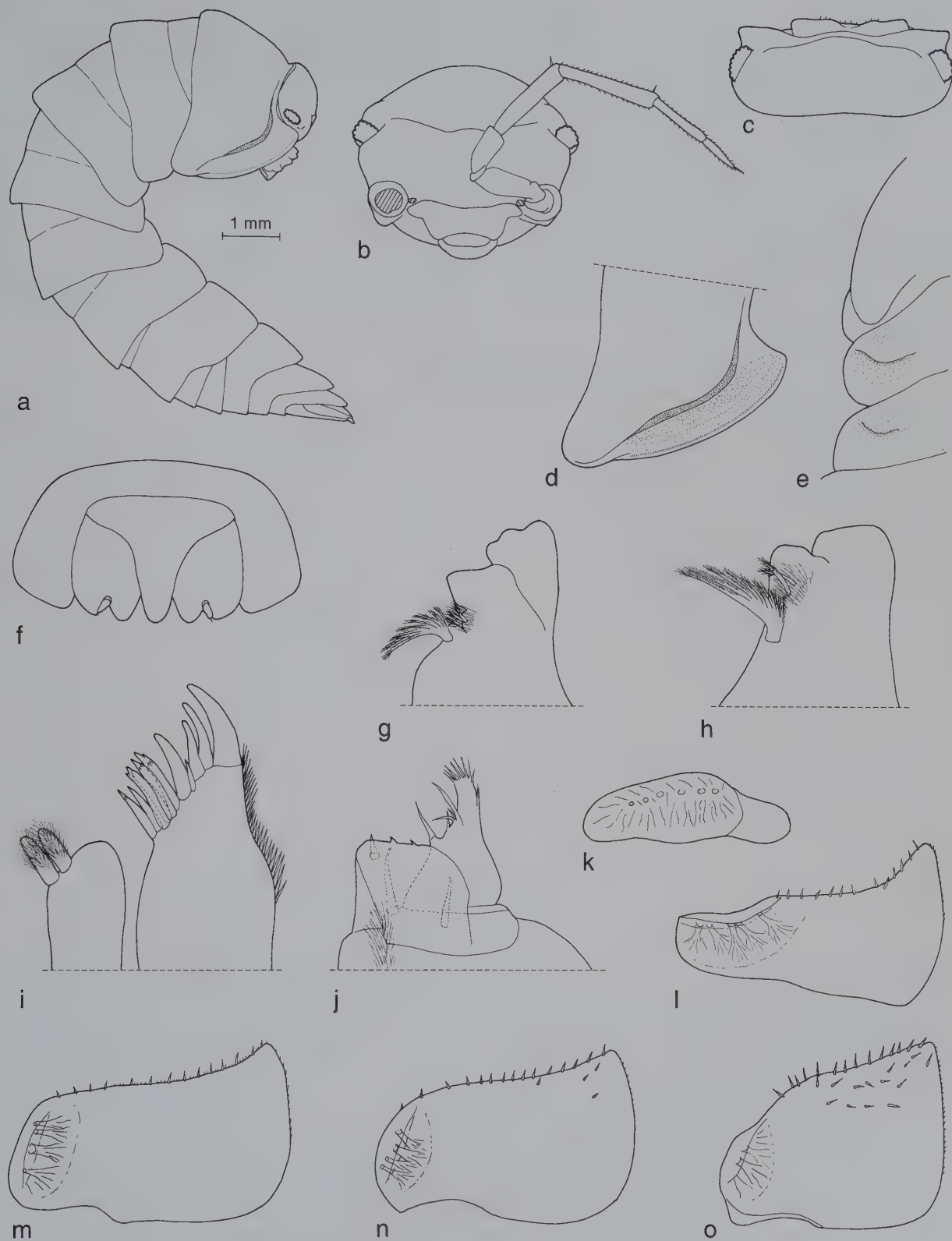


Fig. 8: *Dioscoridillo melanoleucos* n. gen., n. sp., ♀: a, adult specimen in lateral view; b, cephalon in frontal view; c, cephalon in dorsal view; d, right side of pereonite 1 in dorsal view; e, right side of pereonites 1-3 in ventral view; f, pleonite 5, telson and uropods; g, left mandible; h, right mandible; i, maxillule; j, maxilliped; k, exopod of pleopod 1; l, exopod of pleopod 2; m, exopod of pleopod 3; n, exopod of pleopod 4; o, exopod of pleopod 5.

Table 1: List of terrestrial isopods recorded from Yemen (including Socotra).

Family Ligiidae

Ligia pigmentata Jackson, 1922

Family Olibrinidae

Olibrinus sp. [? *antennatus* (Budde-Lund, 1902)]

Family Platyarthridae

Platyarthrus aiasensis Legrand, 1953

Family Trachelipodidae

Agnara madagascariensis (Budde-Lund, 1885)*Socotroniscus sacciformis* n. sp.

Family Porcellionidae

Porcellionides pruinosis (Brandt, 1833)*Porcellio yemenensis* Barnard, 1941

Family Armadillidiidae

Armadillidium vulgare (Latreille, 1804)

Family Eubelidae

Xeroniscus bicoloratus (Barnard, 1941)*Xeroniscus angusticauda* Ferrara & Taiti, 1990*Xeroniscus sulcatus* n. sp.*Periscyphis vittatus* Omer-Cooper, 1926*Periscyphis arabicus* Barnard, 1941*Periscyphis barnardi* Ferrara & Taiti, 1986*Periscyphis besi* Barnard, 1941*Periscyphis minor* n. sp.*Koweitoniscus vanharteni* n. sp.*Angaribia* (?) *lobata* n. sp.*Dioscoridillo melanoleucos* n. sp.

Family Armadillidae

Cubaris murina Brandt, 1833

DISCUSSION

With the six new species (*Socotroniscus sacciformis*, *Xeroniscus sulcatus*, *Periscyphis minor*, *Koweitoniscus vanharteni*, *Angaribia* (?) *lobata* and *Dioscoridillo melanoleucos*) and the three new records (*Platyarthrus aiasensis*, *Agnara madagascariensis* and *Armadillidium vulgare*), the oniscidean fauna of Yemen (including Socotra) numbers 20 species (Table 1), while 40 are now recorded from the whole of the Arabian Peninsula and surrounding islands. Of particular interest is the discovery of two species representing two new genera, on Socotra, the first record of Oniscidea for this island.

The fauna of Yemen is strongly characterised by the presence of Eubelidae, with a high level of diversity (five genera, eleven species) and endemism (nine species). The other families are represented by nine species, most of them widely spread, littoral (*Ligia pigmentata* and *Olibrinus* sp. [*antennatus*?]) or introduced (*Platyarthrus aiasensis*, *Agnara madagascariensis*, *Porcellionides pruinosis*, *Armadillidium vulgare* and *Cubaris murina*), and only two species autochthonous (*Porcellio yemenensis* and *Socotroniscus sacciformis*). On the whole, this fauna is mostly Afrotropical in origin, as indicated by the high presence of eubelids, and connected in particular with the Horn of Africa (*Xeroniscus* and *Periscyphis* spp.), which most probably represents the main source of the popu-

lation. However, the presence of an autochthonous species of *Porcellio* (as already discussed, nothing can be said about the origin of *Socotroniscus*) is proof of the penetration into the Arabian Peninsula of Palaearctic elements, which, in contrast, are completely absent in Somalia, Ethiopia and Eritrea.

ACKNOWLEDGEMENTS

We wish to express our sincerest thanks to Dr. M. Türkay and Mr. A. Allspach (SMF) for the loan of materials.

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Further Records of Scolopendromorph and Geophilomorph Centipedes from the Arabian Peninsula with a Note by Dr. E.H. Eason on *Lithobius erythrocephalus cronebergii* Sseliwanoff

John G.E. Lewis

Abstract: Data are given on the variation and distribution of eight species of scolopendromorph centipedes, seven species of geophilomorph and one lithobiomorph from the Arabian Peninsula. Identification keys are provided for the scolopendromorphs and geophilomorphs and distribution maps given for most species. A new species of *Ribautia* (Geophilidae) is described from Yemen.

تسجيلات أخرى لعديدات الأرجل Scolopendromorpha و Geophilomorpha من شبه الجزيرة العربية مع ملحوظة من الدكتور إيسن عن النوع *Lithobius erythrocephalus cronebergii*

جون لويس

خلاصة : يتضمن البحث معلومات عن التنوع والتوزيع الجغرافي لثمانية أنواع من عديدات الأرجل Scolopendromorpha (أم أربع وأربعين) وسبعة أنواع من التي تعيش داخل التربة Geophilomorpha ونوع واحد من التي تعيش تحت الأحجار Lithobiomorpha من شبه الجزيرة العربية. وكذلك يتضمن البحث مفاتيح تصنيفية للأنواع من رتبة Scolopendromorpha و Geophilomorpha وخرائط للتوزيع الجغرافي لمعظم هذه الأنواع. وفي هذا البحث وصف لنوع جديد للعلم من اليمن يتبع الجنس *Ribautia*.

INTRODUCTION

Recent publications on the centipedes of Saudi Arabia (LEWIS 1986), Oman and the United Arab Emirates (LEWIS 1989, LEWIS & GALLAGHER 1993) and Yemen (LEWIS & WRANIK 1990) have steadily increased our knowledge of the species composition and distribution of centipedes in the peninsula. Further data are added here for Kuwait, Saudi Arabia and Oman based on the extensive material in the Natural History Museum, Basel, mostly collected by Professor W. Büttiker. Further data on Yemen centipedes are based on specimens in the Zoological Museum, Copenhagen, collected largely by Dr. A. van Harten. A few specimens examined came from the Oman Natural History Museum, Muscat (ONHM) and the Natural History Museum, London (BMNH). Unless otherwise indicated the specimens listed below from Yemen are in the Zoological Museum, Copenhagen, and the remainder in the Natural History Museum, Basel. Keys to the species and distribution maps are given. Figures 1 and 2 show the location of the collecting sites.

Records for the Island of Socotra are not included. The large collection in the Natural History Museum, London, upon which POCKOCK's (1903) paper was based, requires re-evaluation.

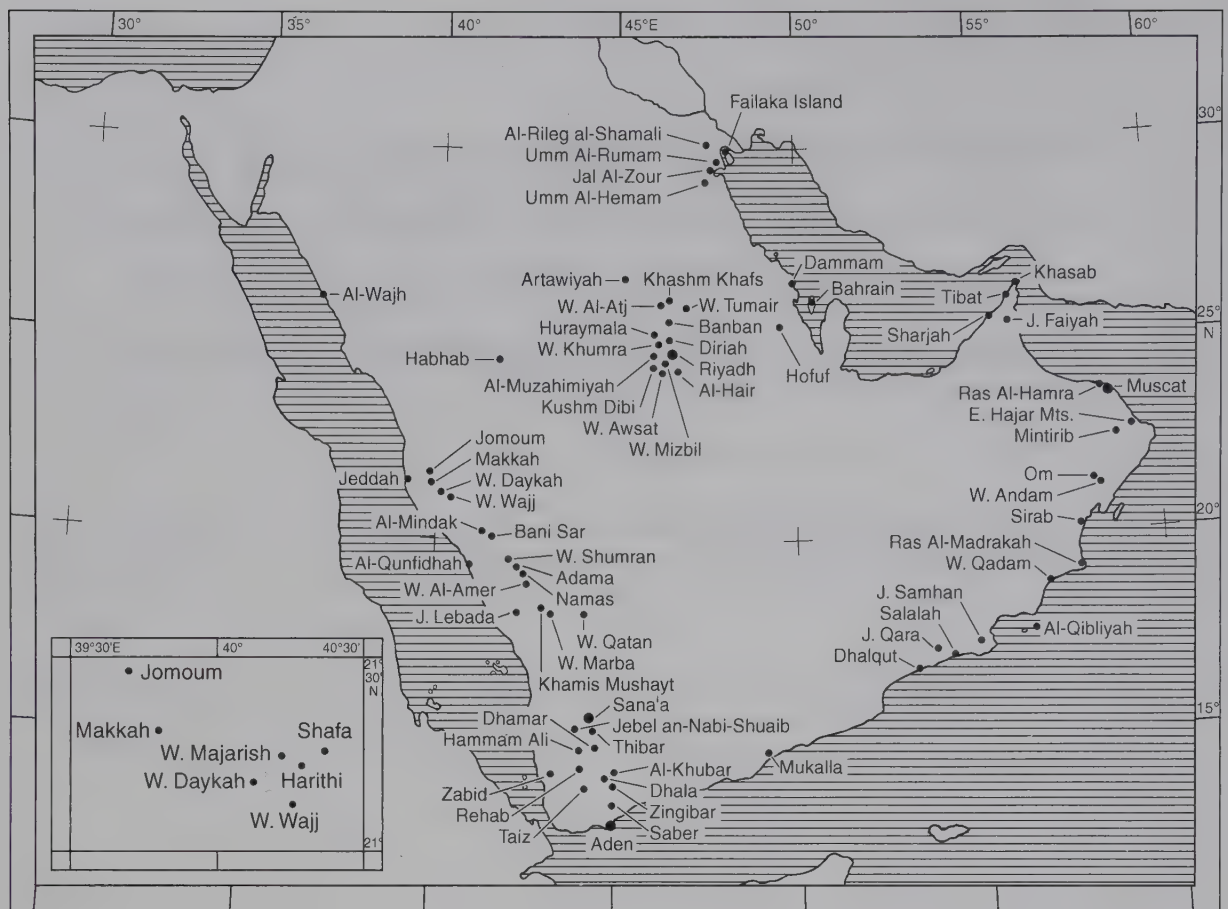


Fig. 1: Location of collecting sites for centipedes in the Arabian Peninsula. Inset: localities around Makkah. See Fig. 2. for all Oman localities.

Order Scolopendromorpha

Key to the Scolopendromorpha of the Arabian Peninsula

- | | | | |
|---|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|---|
| 1 | Without ocelli. First tergite without a ring sulcus or sutures | <i>Cryptops niloticus</i> | |
| — | With four ocelli on each side of head | | 2 |
| 2 | Prefemora of last pair of legs with spines | | 3 |
| — | Prefemora of last pair of legs without spines | | 8 |
| 3 | Spiracles each an elongated triangle, the apex anterior and the axis more or less parallel with the longitudinal axis of the body. With a tripartite valve | | 4 |
| — | Spiracles round or oval, the axis oblique or vertical, without valves | | 7 |
| 4 | First tergite with ring sulcus, prefemur of legs 19 and 20 with spines dorsally at distal end | <i>Scolopendra valida</i> | |
| — | First tergite without ring sulcus, prefemur of legs 19 and 20 without dorsal spines | | 5 |
| 5 | Posterior border of head capsule resting in transverse groove on, or touching, anterior border of tergite 1. Head capsule with basal plates and diverging longitudinal sutures, forcipular coxosternum with ramifying sutures | <i>Scolopendra mirabilis</i> | |

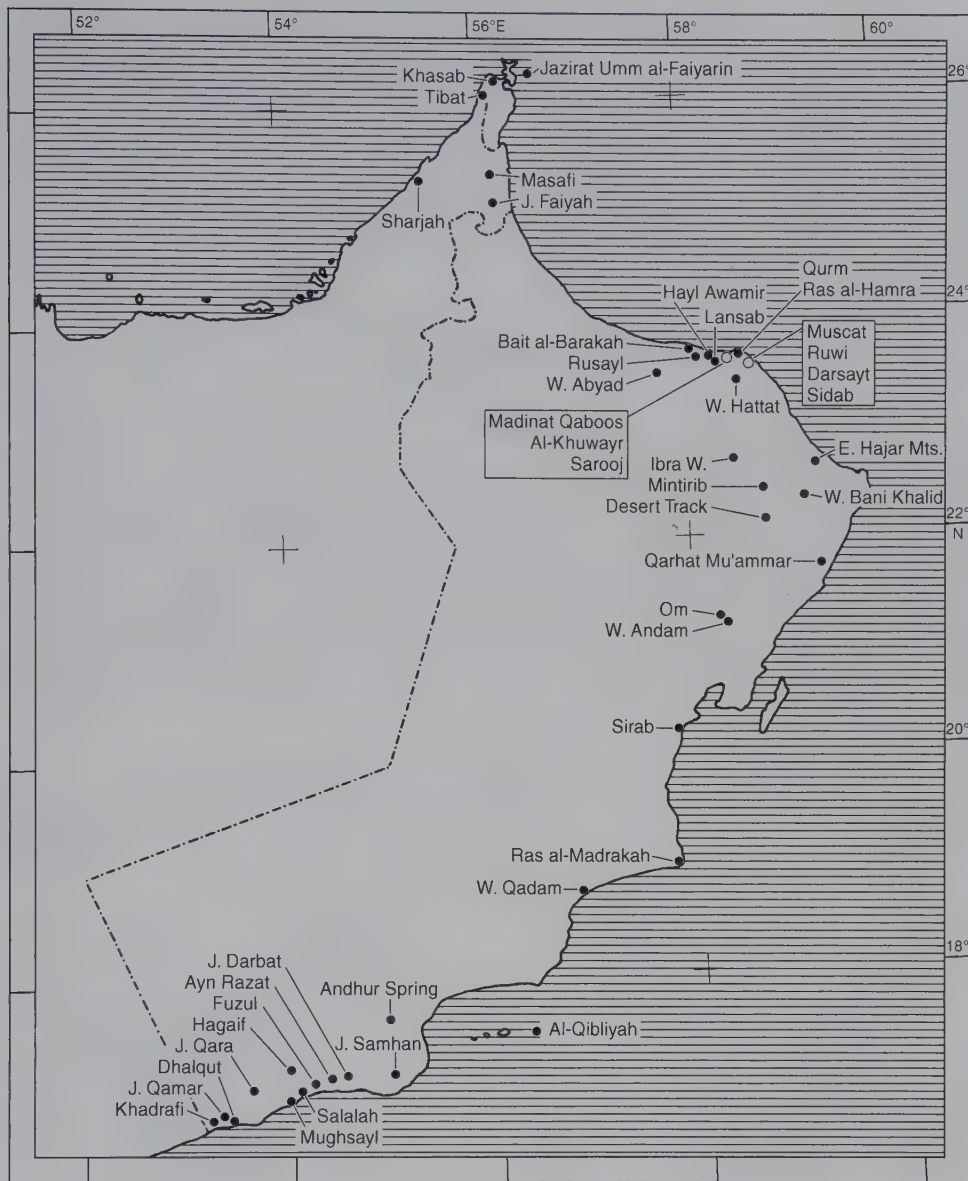


Fig. 2: Location of collecting sites for centipedes in Oman.

- Head capsule overlying the first tergite, without basal plates or diverging longitudinal sutures, forcipular coxosternum without ramifying sutures 6
- 6 Prefemora of last pair of legs with 11-14 ventrolateral spines, 6-11 ventromedial spines and 7-8 dorsomedial spines, each in a double row *Scolopendra canidens*
- Prefemora of last pair of legs typically with single rows of 3 ventrolateral, 3 medial and 3 ventromedial spines and 4-6 dorsomedial spines in two rows *Scolopendra morsitans*
- 7 Coxopleural process of last pair of legs short with (1) 2 (3) end spines, without dorsal or lateral spines. Prefemur with 2 ventral and 1-2 dorsomedial spines. No corner spine *Rhysida lithobioides paucidens*

- Coxopleural process of last pair of legs long or moderately long with (2) 3 or 4 end spines, a lateral spine. Prefemora with 4 or more ventral spines in two rows and 2-3 dorsomedial spines and a corner spine *Rhysida longipes longipes*
- 8 Prefemora of last pair of legs relatively slender, ratio of width to length 1:1.5 to 1:1.94 *Asanada walkeri*
- Prefemora of last pair of legs relatively broad, ratio of width to length 1:1 to 1:1.45 *Asanada socotrana*

Family Scolopendridae

Scolopendra morsitans Linnaeus, 1758

Scolopendra morsitans Linnaeus, 1758. — Syst. Nat. ed. 10: 638.

Material: Oman: 1 spm., 68 mm, Salalah, Dhofar, 17°00'N 54°10'E, 6 m, 4.X.1985, A.P. Whitecombe.

Remarks: This female specimen has 20-20 antennomeres of which the basal six are glabrous. Tergal paramedian sutures commence on T 3 and tergal margination begins on T 17. Coxopleural process of last pair of legs with 4-4 spines. Side spines 0-1. Legs 1-19 with one tarsal spine.

The species, although widely distributed in the tropics, is apparently limited to the coasts of Dhofar and the Hadramaut (Fig. 3).

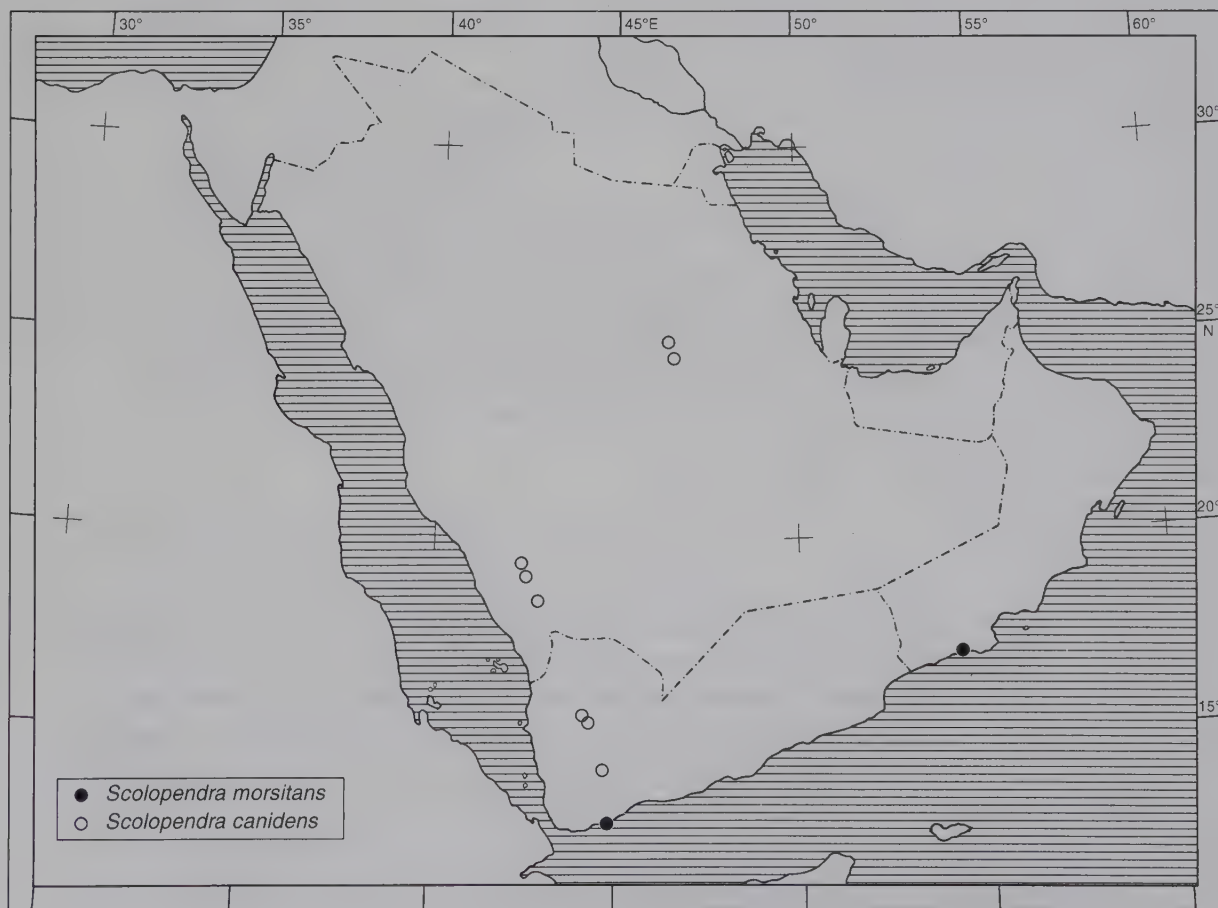


Fig. 3: The distribution of *Scolopendra morsitans* and *S. canidens* in the Arabian Peninsula.

Scolopendra mirabilis (Porat, 1876) (Figs 5-9)

Cormocephalus mirabilis Porat, 1876. — Bih. Svenska Akad. 4: 18.

Trachycormocephalus mirabilis — Kraepelin 1903; Mt. Mus. Hamburg 20: 219.

Scolopendra mirabilis. — Lewis 1987; J. nat. Hist. 20: 1083.

Material: Saudi Arabia: 2 spms, 54 and 42 mm, Driah (= Diriah) ca 20 km N of Riyadh, 600 m, 26.II.1980, A.S. Talhouk; 1 spm., 45 mm, Riyadh, 20.II.1976, W. Büttiker; 1 spm., 47 mm, Wadi Araida near Hair, 21.II.1975, W. Büttiker; 1 spm., 54 mm, Jebel Banban, 16.III.1978, W. Büttiker; 1 spm., 42 mm, Dar Arica (= Dar Aridah) near Al-Hair, ca 30 km S of Riyadh, 520 m, 21.II.1975, W. Büttiker; 1 spm., 42 mm, Wajh, 31.XII.1976, W. Büttiker; 1 spm., 50 mm, R. Villa, Riyadh, 6.IV.1975, W. Büttiker; 1 spm., 56 mm, Wadi Tumair, 20.II.1976, W. Büttiker; 1 spm., 49 mm, Wadi Awsat, 19.XII.1987, W. Büttiker; 1 spm., 36 mm, Riyadh Wireless Station, 18.II.1975, W. Büttiker; 1 spm., 33 mm, Kushm Dibi, 20.IV.1978, W. Büttiker; 1 spm., 68 mm, Muzahimiyah, 12.III.1976, W. Büttiker; 1 spm., 32 mm, Petrified Forest near Riyadh, 26.III.1976, W. Büttiker; 1 spm., Arabian Sea, Ship Dalrymple, Ser. No. 4/60, 21°47'N 61°56'E, 22 fathom dredge, 16.III.1960, BMNH; 1 spm., 60 mm, Wadi Dawasir, 18.III.1932, H.M. King of the Hedjaz, Maj. H.St.J.B. Philby, BMNH 1932.6.28.13; 1 spm., 44 mm, Jidda, II.1934, G.L. Bates, BMNH 1934.6.14.6; 2 spms, 60 and 46 mm, Qunfidan (= Al-Qunfidhah), 3.I.1946, L.A. Tillin, BMNH 1948-19. — Oman: 1 spm., 77 mm, Madinat Qaboos, Muscat, 23°36'N 58°26'E, 50 m, 1986, A.B. Patrinien; 1 spm., 21 mm, Ibra, wadi, 22°41'N 58°28'E, 542 m, 16.I.1986, eastern Sands Project, W. Büttiker; 1 spm., 47 mm, near Rusayl, 23°42'N 58°13'E, 50 m, 27.V.1983, M.D. Gallagher; 1 spm., Fuzul, Gt. S. Arabian desert, 14.XI.1930, 1350 feet, Capt. B.S. Thomas, BMNH 1931.6.2.55. — Kuwait: 2 spms, 48 and 34 mm, Jal Al-Zour, 29°27'N 47°44'E, 15 m, 24.III.1988, W. Büttiker; 1 spm., 65 mm, Al-Rileg al-Shamali, 30°05'N 47°28'E, 78 m, 26.III.1988, W. Büttiker; 4 spms, 33, 52, 44 and 29 mm, Umm Al-Hemam, 28°57'N 48°12'E, 12 m, 8.III.1986, W. Büttiker; 1 spm., 80 mm, Wadi Umm Al-Rumam Desert, 29°33'N 47°44.5'E, 18.II.1988, W. Büttiker; 1 spm. (fragmented), 56 mm, Wadi Umm Al-Rumam Farm, 29°33'N 47°42.5'E, 90 m, 18.II.1988, W. Büttiker; 1 spm., 35 mm, Failaka Island, 29°23'N 47°43'E, 18.II.1988, W. Büttiker. — Yemen: 1 spm., 55 mm, Hamam Damt, 17.III.1991, A. van Harten; 2 spms, 38 and 31 mm, Taiz, 19.XII.1991, A. van Harten.

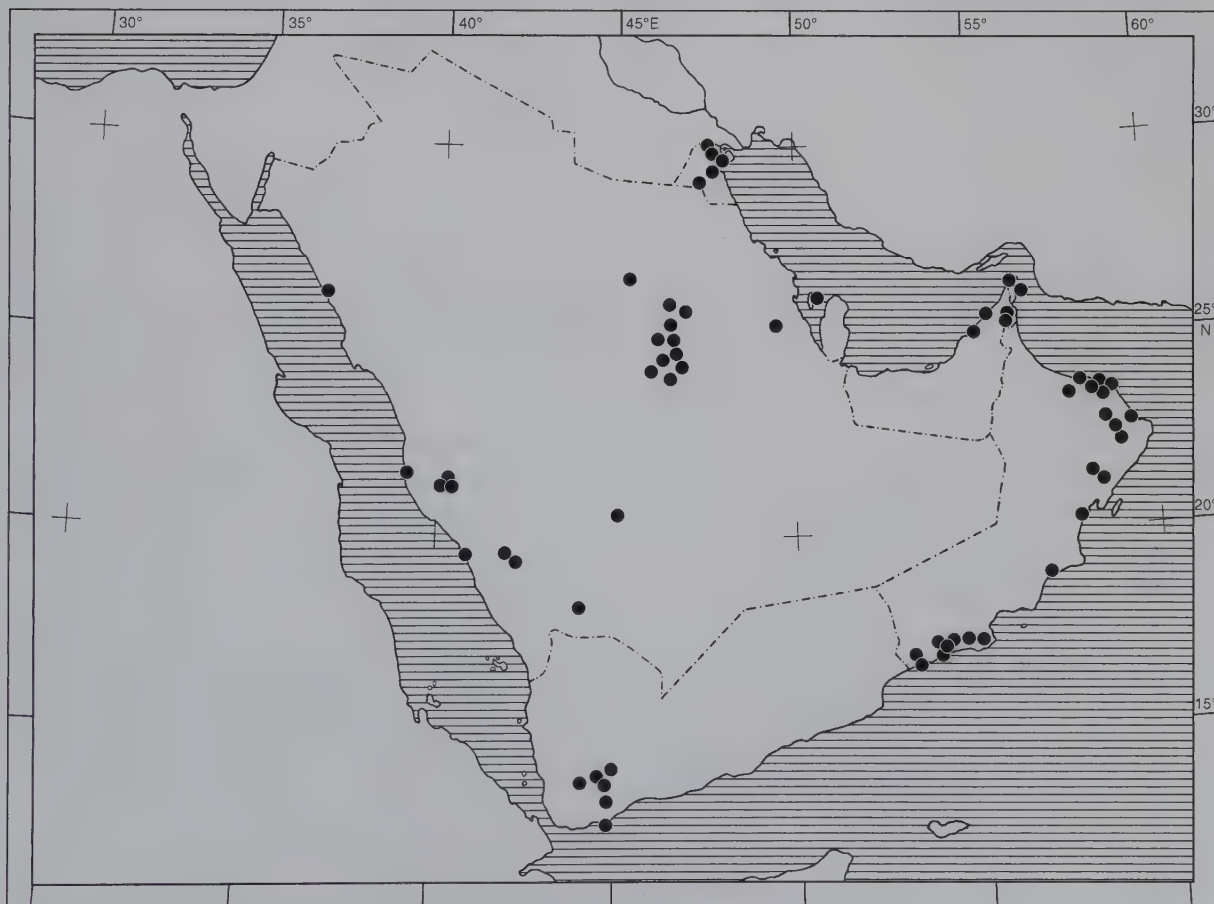


Fig. 4: The distribution of *Scolopendra mirabilis* in the Arabian Peninsula.

Remarks: *S. mirabilis* is the most common and widely distributed centipede on the Arabian Peninsula (Fig. 4). It has been recorded from NE and E Africa, the Middle East, Iraq, Iran, and eastwards into India, Afghanistan, Turkmenistan, Tadjikistan and Uzbekistan.

The Arabian Peninsula material shows considerable variation. It is summarised in Table 1 which includes some data previously recorded but unpublished. Most notable is the bilateral presence of two side spines in all but one of the specimens from Kuwait (Fig. 5). Populations show variation in the number of spines on the prefemora of the last pair of legs: specimens with high spine numbers tend to have three rather irregular ventral median rows rather than the usual two. One specimen from Jal Al-Zour in Kuwait has a very low spine number (Fig. 6). Most Omani specimens have very short coxopleural processes (Fig. 7) but in the specimen from Fuzul the process is very long (Fig. 8).

Table 1: Variation in populations of *Scolopendra mirabilis* from the Arabian Peninsula. Extreme measurements are shown in parentheses. * Data from specimens examined by LEWIS (1989) and LEWIS & GALLAGHER (1993). ** Data from specimens examined by LEWIS & WRANIK (1990).

| | Kuwait | Kuwait | Saudi Arabia (Riyadh area) | Oman* | North Yemen | South Yemen** |
|------------------------------------------------------|------------|--------|-------------------------------|--------|----------------|------------------|
| Sample size | 7 | 1 | 12 | 10 | 3 | 5 |
| Number of specimens with ramifying sutures on T 1 | 0 | 0 | 0 | 6 | 1 | 3 |
| Tergite on which margination begins | 15, 17, 18 | 19 | 15, 17, 18 | 18, 19 | 18, 19 | 18, 19 |
| Coxopleural spines | 5(6) | 3-4 | (3) 5 (6) | 4 (6) | 5 | (3) 4 (5) |
| Side spines | 2 | 1 | (0) 1 (2) | 1 | (0) 1 (2) | 1 (2) |
| Number of spines on pre-femora of last legs | 18-27 | 12-14 | 17-25 | 17-21 | 19-22 | 16-19 |

LEWIS & GALLAGHER (1993) noted the presence of ramifying sutures on tergite 1 in some specimens from Oman and the United Arab Emirates and concluded that the character could have been overlooked hitherto or might have been local. In the present material specimens from Kuwait and the Riyadh area lack the sutures which are present in some but not all of the specimens from other areas including Qunfidhah, Jeddah and Wadi Dawasir in Saudi Arabia. Different populations of *S. mirabilis* could be regarded as subspecies, indeed the larger specimen from Jal Al-Zour differs to such an extent from the other Kuwait specimens that it could be regarded as a distinct species. The data available suggests that at least some variation is mosaic and is best simply noted at this stage to await a detailed study in the field.

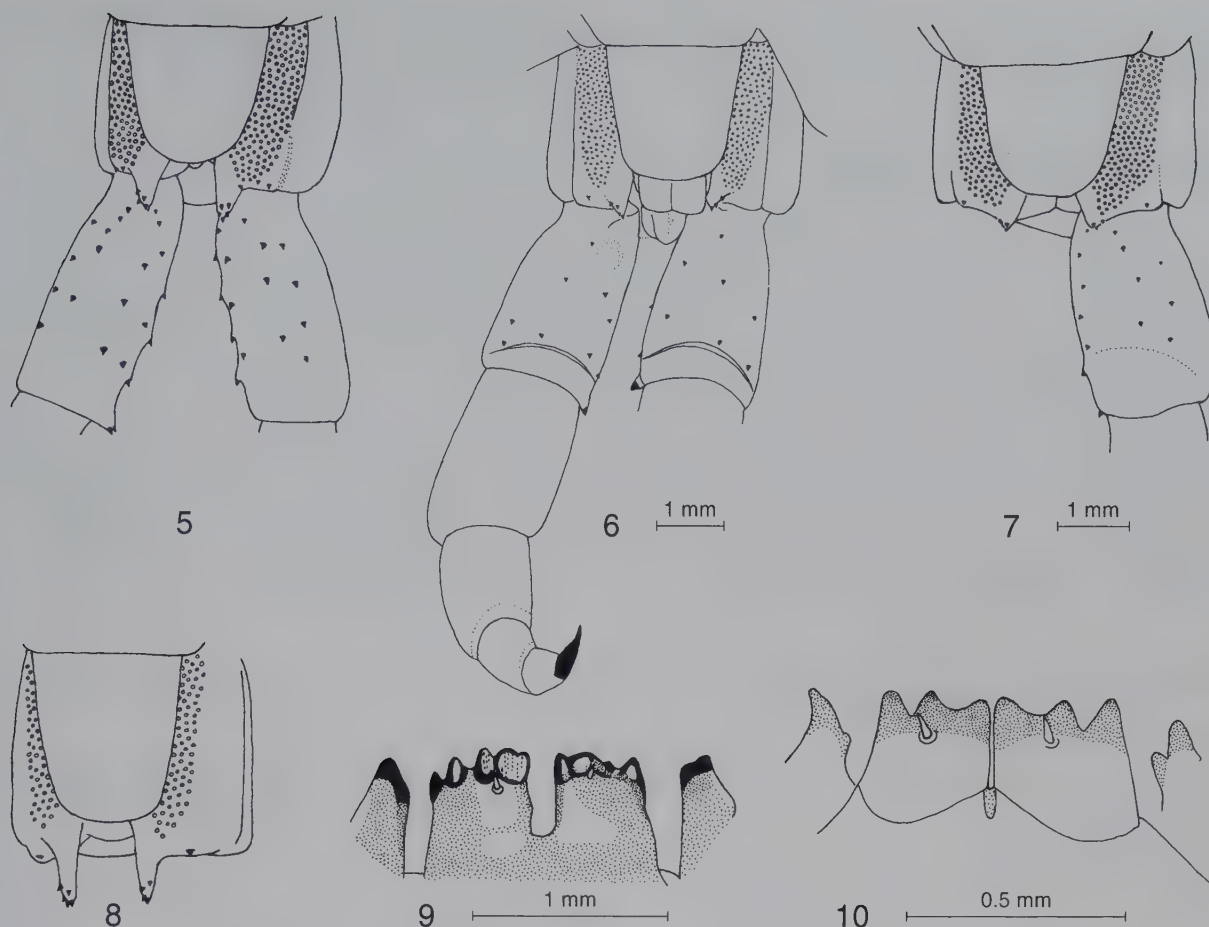
The specimen from Muzahimiyah has abnormal forcipular coxosternal teeth. Instead of 3+1 on each side there are 2+3 on the right and only 3 with the central tooth by far the largest on the left (Fig. 9). The teeth on the right are not unlike those of *S. morsitans* in arrangement.

It seems highly improbable that the BMNH specimen labelled as being dredged from the Arabian Sea in fact came from a marine habitat.

Scolopendra canidens Newport, 1844

Scolopendra canidens Newport, 1844. — Ann. Mag. nat. Hist. 13: 98.

Material: Saudi Arabia: 2 spms, 66 and 27 mm, Driah (= Diriah) ca 20 km N of Riyadh, 26.II.1980, A.S. Talhouk; 1 spm., 63 mm, BAC Camp, Khamis Mushayt, 2000 m, 15.XI.1977, W. Büttiker. — Yemen: 1 spm., 77 mm, Sana'a,



Figs 5-10: 5-9, *Scolopendra mirabilis*: 5, ventral view of terminal segments and prefemora of last legs, specimen from Al-Rileg al-Shamali, Kuwait; 6, ventral view of terminal segments and left last leg, specimen from Jal Al-Zour, Kuwait; 7, ventral view of terminal segments and prefemur of left last leg, specimen from near Rusayl, Oman; 8, ventral view of terminal segments, specimen from Fuzul, Oman; 9, coxosternal toothplates, specimen from Al-Muzahimiyah, Saudi Arabia. 10, *Scolopendra valida*, coxosternal toothplates, juvenile specimen from Rehab, Yemen.

19.III.1991, A. van Harten; 1 spm., 27 mm, Sueda (near Sana'a), 17.III.1991, A. van Harten; 2 spms, 44 and 17 mm, Sana'a, IV.1992, M. Knapp.

Remarks: A Mediterranean species extending eastwards into Iran and southwards into Saudi Arabia as far as Riyadh in the east and Yemen in the south-west (Fig. 3).

Scolopendra valida Lucas, 1840 (Fig. 10)

Scolopendra valida H. Lucas, 1840. — In: Webb & Berthelot, Hist. Canar. 2, II Ent.: 49, Figs 13-14.

Scolopendra angusta H. Lucas, 1840. — loc. cit.

Scolopendra valida. — Lewis 1967; Proc. zool. Soc. Lond. 178: 187, Figs 55-57.

Material: Saudi Arabia: 1 spm., 77 mm, Wadi Marba, Khamis Mushayt, 2050 m, 17.IV.1976, W. Wittmer, W. Büttiker; 1 spm., 22 mm, Makkah, Al-Uqdah, 21°07'N 40°25'E, 1780 m, W. Büttiker. — Oman: 1 spm., 64 mm, near Rusayl, 23°42'N 58°13'E, 50 m, 27.V.1983, M.D. Gallagher. — Yemen: 1 spm., 21 mm, Rehab, 14°14'N 44°07'E, 29.III.1992, M. Knapp; 1 spm., 22 mm, Hammam Ali, 14°42'N 44°06'E, 5.VIII.1991, A. van Harten.

Remarks: The species is recorded from the Canary Islands, Cameroon, Sudan, Eritrea, the Middle East, India and Malaysia. It is widely distributed in the Arabian Peninsula (Fig. 11). The

arrangement of the teeth on the forcipular coxosternal toothplates in a juvenile specimen from Rehab is shown in Fig. 10.

Asanada socotrana Pocock, 1899

Asanada socotrana Pocock, 1899. — Bull. Lpool. Mus. 2: 9.

Material: Saudi Arabia: 3 spms, 22, 20 and 17 mm, Harithi, 21°18'N 40°18'E, 1910 m, 18-19.IV.1985, W. Büttiker. — Oman: 1 spm., 40 mm, pale orange yellow with red dorsal stripe, yellow legs, end legs bright orange, Wadi Bani Khalid, 23.II.1990, M.J. Ebejer; 1 spm., 20 mm, Andhur spring, 30.XII.1945, W. Thesiger, BMNH.

Remarks: The characters of these specimens are compared in Table 2. Specimens from Harithi and Wadi Bani Khalid are similar to those previously described from Shafa and Dhofar.

LEWIS (1973) described two forms of *A. socotrana* from Nigeria: Form 1 with incomplete femoral sulci and 6-20 teeth on the terminal claw, and Form 2 with complete femoral sulci and 22-49 teeth. These forms appear to be separate species but as insufficient data were available for the status of other populations to be determined, both were regarded as *A. socotrana*. The problem has yet to be resolved. The specimens from the Arabian Peninsula resemble the Nigerian Form 2 (Table 2). Their distribution in the Arabian Peninsula is shown in Fig. 12.

Asanada walkeri (Pocock, 1891)

Pseudocryptops walkeri Pocock, 1891. — Ann. Mag. nat. Hist. (6) 7: 226, Fig. 3.

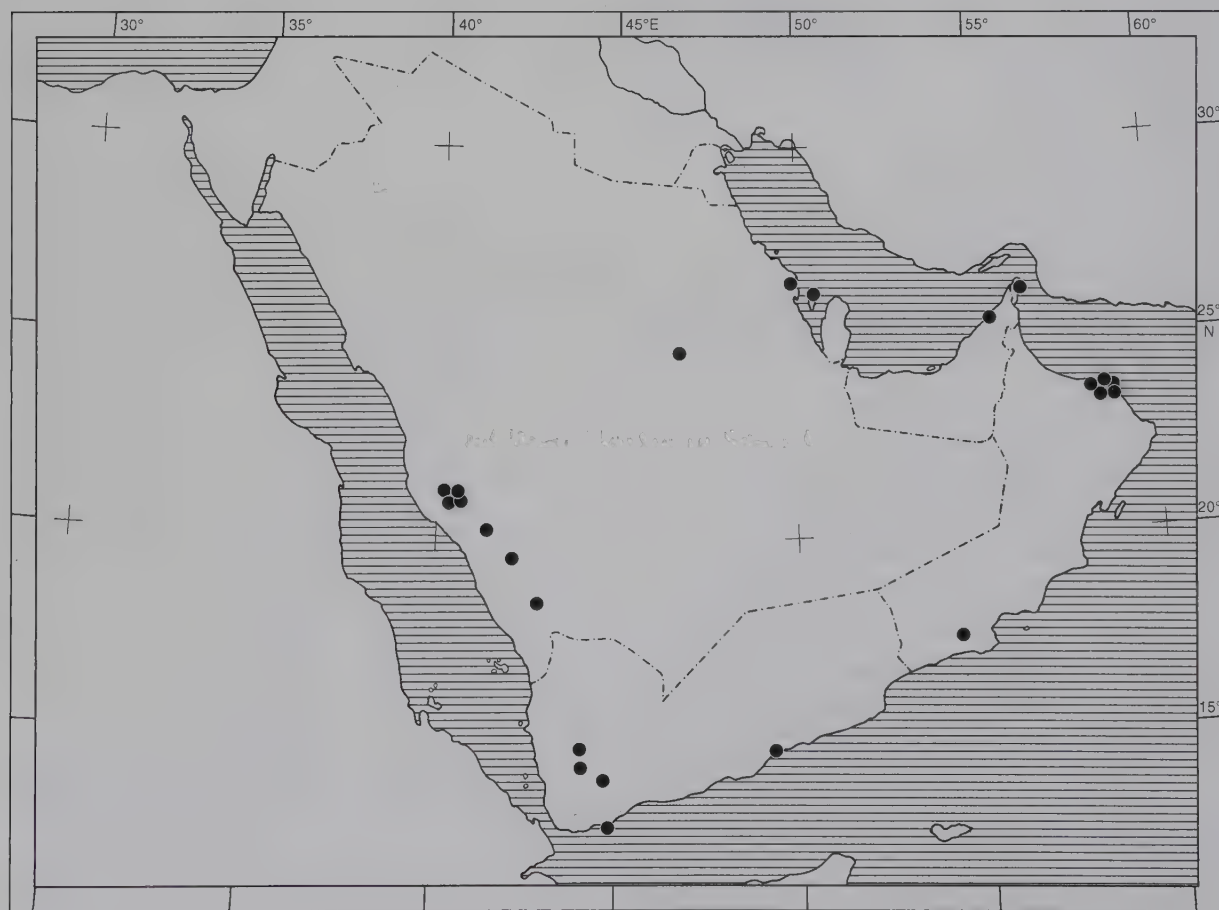


Fig. 11: The distribution of *Scolopendra valida* in the Arabian Peninsula.

Material: Saudi Arabia: 1 spm., 31 mm, Jebel Lebada, 24.III.1985, J. Grainger; 1 spm., Dar Arica (= Dar Aridah) near Al-Hair, ca 30 km S of Riyadh, 520 m. — Yemen: 1 spm., 32 mm, Zabid, 20.XII.1991, among termites, M. Seif, A. van Harten.

Remarks: The characters of the specimens are summarised in Table 2. The ratios of width to length of the terminal prefemur are smaller than those given for the species by LEWIS (1986). The species is recorded from Africa and India. Its distribution in the Arabian Peninsula is shown in Fig. 12.

Table 2: Characteristics of *Asanada socotrana* and *A. walkeri* from the Arabian Peninsula.

| | <i>Asanada socotrana</i> | | | | <i>Asanada walkeri</i> | | |
|------------------------------|--------------------------|--------------|-------|---------------------|------------------------|-----------------|---------------|
| | 1 | Harithi 2 | 3 | Wadi Bani Khalid | Zabid | Jebel Lebada | Dar Aridah |
| Length (mm) | 17 | 22 | 20 | 40 | 32 | 31 | 26 |
| Sternite 21 ratio L:W | 1:3.3 | 1:2.2 | 1:2.4 | 1:1.9 | 1:1.6 | 1:1.35 | 1:1.4 |
| Last legs | | | | | | | |
| Femoral sulcus complete | yes | yes | yes | yes | no | no | no |
| Ratio tarsus 2:terminal claw | 1:1 | 1:0.8 | 1:1 | 1:1 | 1:0.9 | 1:0.8 | 1:0.6 |
| Teeth on claw | 40 | 34 | 34 | 27 | 13-9 | 13-14 | 10 |
| Prefemur ratio W:L | 1:1.17 | 1:1.35 | - | 1:1.1 | 1:1.75 | 1:1.5 | 1:1.65 |

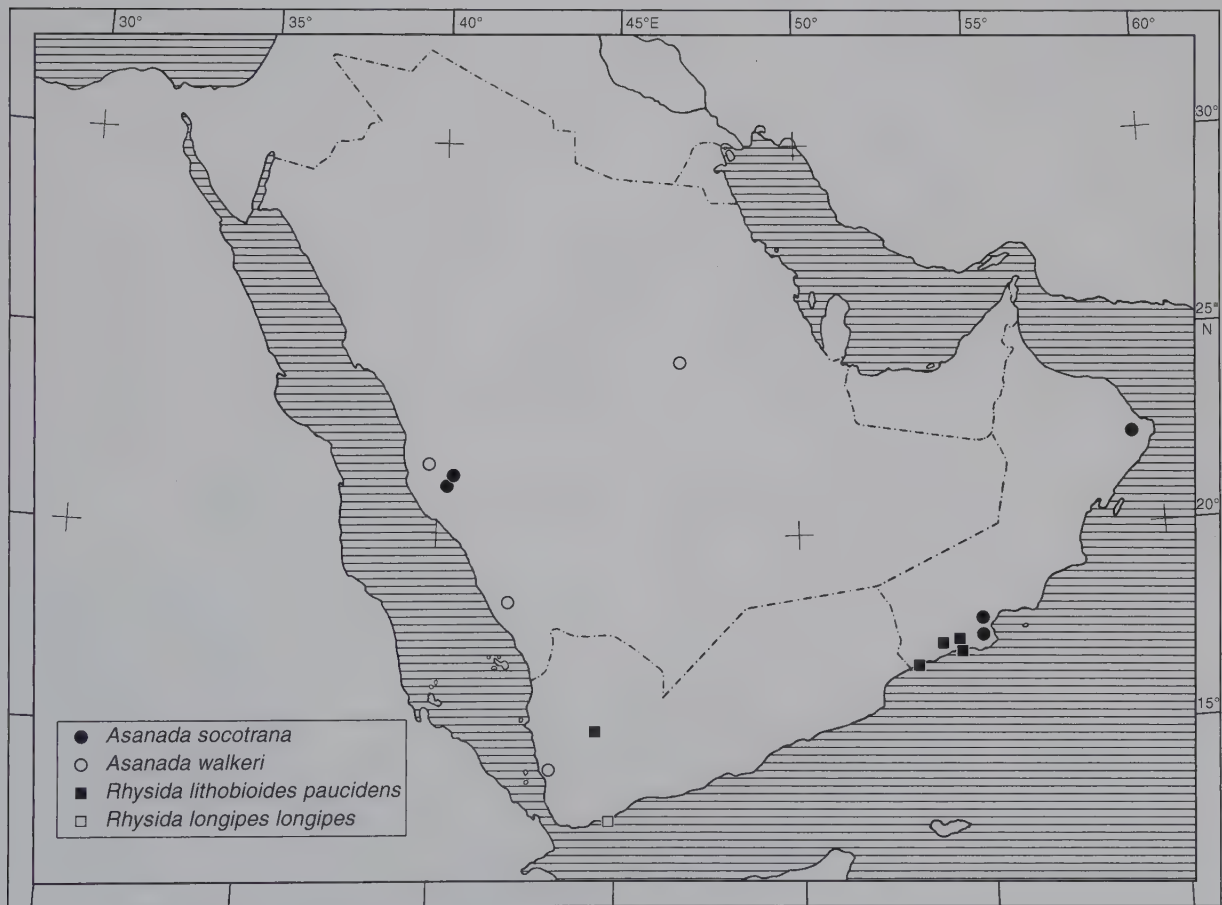


Fig. 12: The distribution of *Asanada socotrana*, *A. walkeri*, *Rhysida lithobioides paucidens* and *R. longipes longipes* in the Arabian Peninsula.

Rhysida lithobioides paucidens Pocock, 1897 (Fig. 13)

Rhysida lithobioides paucidens Pocock, 1897. — In: Smith, D., Unknown Afr. Countries, app. C: 403.

Material: Oman: 1 spm., 50 mm, Salalah, Gadaur, 17°07'N 53°59'E, 15.III.1991, in fodder, Saleem, ONHM 1940. — Yemen: 1 spm., 40 mm, Sana'a × Mabbar near Thibar, 12.III.1991, A. van Harten.

Remarks: The specimens are very similar to the three specimens previously described from Dhofar. In the Salalah specimen the last pair of legs have been regenerated and show abnormal spinulation: 10 spines in 5 rows on the right (Fig. 13) and 6 in 4 rows on the left. The species has been recorded from East Africa and India. In the Arabian Peninsula it appears to be limited to southern Oman and the Yemen (Fig. 12). *R. longipes longipes* (Newport) was recorded from Aden by LEWIS & WRANIK (1990).

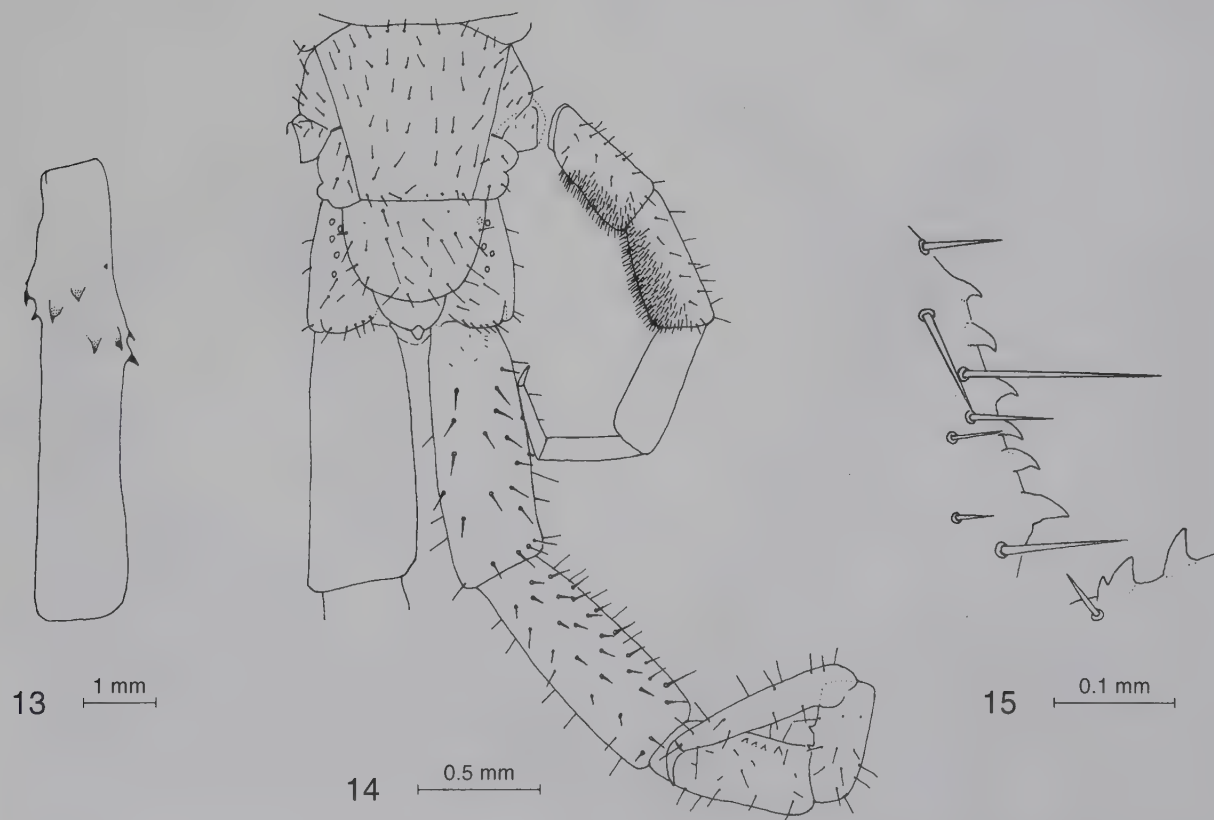
Family Cryptopidae

Cryptops niloticus Lewis, 1967 (Figs 14-15)

Cryptops niloticus Lewis, 1967. — Proc. Linn. Soc. Lond. 178: 201, Figs 23-37.

Material: Yemen: 1 ♂, 11 mm, Sana'a × Mabbar near Thibar, 12.III.1992, A. van Harten.

Remarks: The specimen shows median longitudinal and transverse sulci on the sternites when viewed by reflected light. These were not noted by LEWIS (1967) who may have overlooked the character. There are 5-5 pores (Fig. 14) on the coxopleura of the last pair of legs and 5-6 teeth



Figs 13-15: 13, *Rhysida lithobioides paucidens*, right prefemur of end leg, ventral view; 14-15: *Cryptops niloticus*: 14, ventral view of terminal segments; 15, tarsal and tibial combs of last leg.

on the tarsal combs and 3-3 on the tibial combs (Fig. 15). The species has been recorded from Khartoum, Sudan and Asmara, Eritrea.

Order Geophilomorpha

Key to the Geophilomorpha of the Arabian Peninsula

- | | | |
|---|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|
| 1 | Head capsule about as wide, or wider than long. 71 pairs of legs or more | 2 |
| — | Head capsule much longer than wide (Fig. 32). 53 pairs of legs or less | 5 |
| 2 | Coxopleura of last leg-bearing segment without gland pores. Sternal pores in two transverse bands, subdivided into four groups in most segments | 3 |
| — | Coxopleura of last leg-bearing segment with gland pores opening into a pit or pits. Sternal pores in a single group (Fig. 19) | 4 |
| 3 | Anterior sternal pore groups reduced to a few pores in the posterior half of the body | |
| | <i>Orphnaeus meruinus</i> | |
| — | The four sternal pore groups with numerous pores | <i>Orphnaeus brevilabiatus</i> |
| 4 | Coxopleural gland pores of last leg-bearing segment opening into a dorsal and a ventral pit (Fig. 19). Some anterior sternites with a median anterior round or oval depression or pit (Figs 17-18) | <i>Bothriogaster signata</i> |
| — | Coxopleural gland pores of last leg-bearing segment opening only into a dorsal pit seen in well-cleared specimens only. Anterior sternites without a median anterior round or oval depression or pit | <i>Polyporogaster tunetana</i> |
| 5 | Anterior sternites with a Y-shaped suture. Sternal pores lacking. 49 pairs of legs | <i>Mecistocephalus insularis</i> |
| — | Anterior sternites without a Y-shaped suture. Sternal pores present | 6 |
| 6 | Coxopleural gland pores numerous, opening over the whole surface of the coxopleuron | <i>Pachymerium caucasicum</i> |
| — | Coxopleural gland pores few, opening under the lateral border of the sternite of the last leg-bearing segment (Fig. 44) | <i>Ribautia arabica</i> |

Family Himantariidae

Bothriogaster signata (Kessler, 1874) (Figs 17-19)

Geophilus signatus Kessler, 1874. — Trudy Russk. ent. Obschtch. St. Peterb. 8: 39.

Bothriogaster signata. — Sseliwanoff 1879; Zool. Anz. 2: 621.

Bothriogaster egyptiaca egyptiaca. Attems — Lewis 1986; Fauna of Saudi Arabia 8: 21.

Bothriogaster signata. — Zapparoli 1991; Fragm. Entomol., Roma 23: 16.

Material: Saudi Arabia: 1 ♂, 48 mm, 91 pairs of legs, Wadi Tumair, 20.II.1976, W. Büttiker; 1 ♀, 55 mm, 107 pairs of legs, Makkah (= Mecca), Al-Uqdah, 21°07'N 40°25'E, 1780 m, 30-31.V.1984, W. Büttiker; 1 ♂, 51 mm, 97 pairs of legs, Bani Sar, 23.II-7.III.1984, W. Büttiker.

Remarks: Median depressions are present on sternites 32-39 (Bani Sar), 27-33 (Wadi Tumair) and 35-42 (Makkah). The shape of two sternal depressions in the specimen from Makkah are shown in Figs 17-18: both are asymmetrical. Figure 19 shows the distribution of coxopleural pores of the last leg-bearing segment. The distribution of the species in the Arabian Peninsula is shown in Fig. 16.

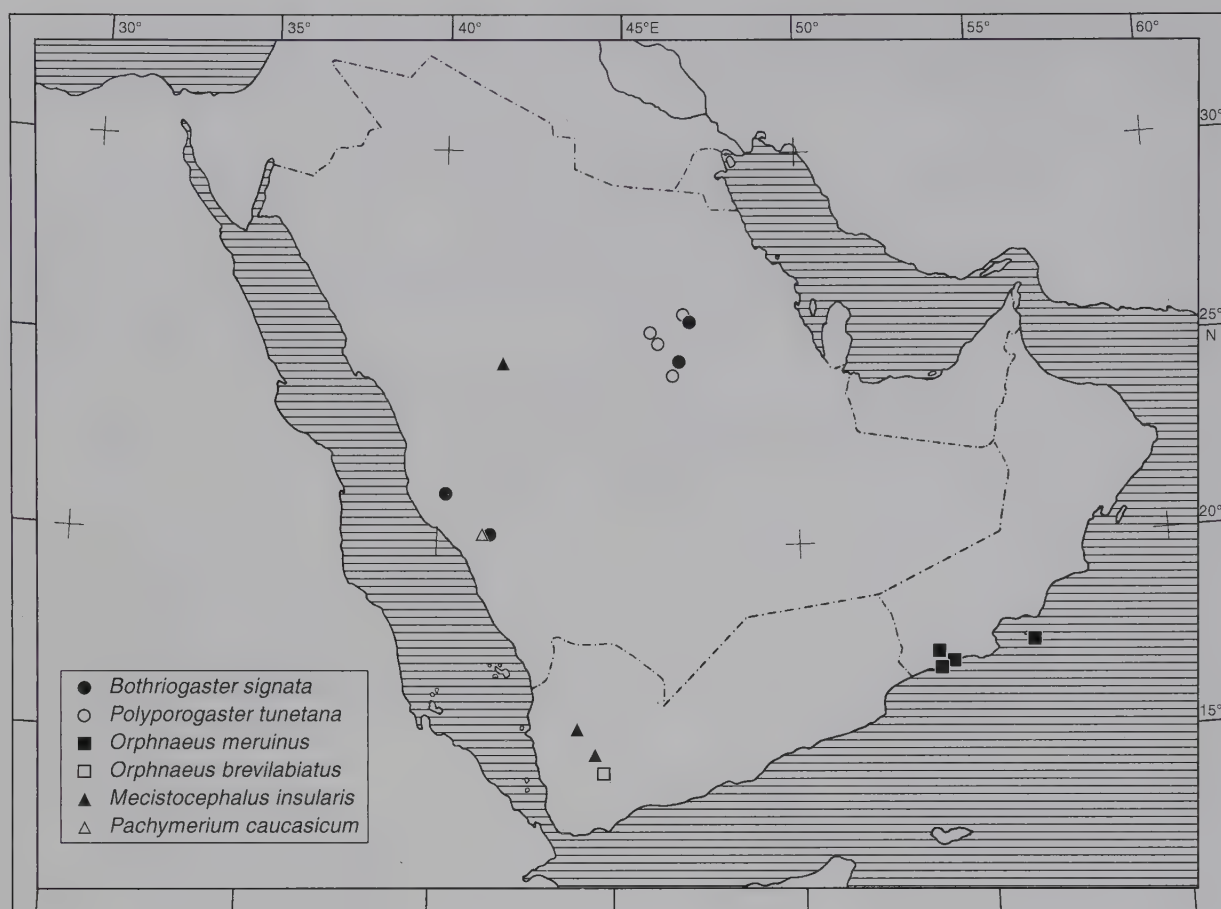


Fig. 16: The distribution of *Bothriogaster signata*, *Polyporogaster tunetana*, *Orphnaeus meruinus*, *O. brevilabiatus*, *Mecistocephalus insularis* and *Pachymerium causicum* in the Arabian Peninsula.

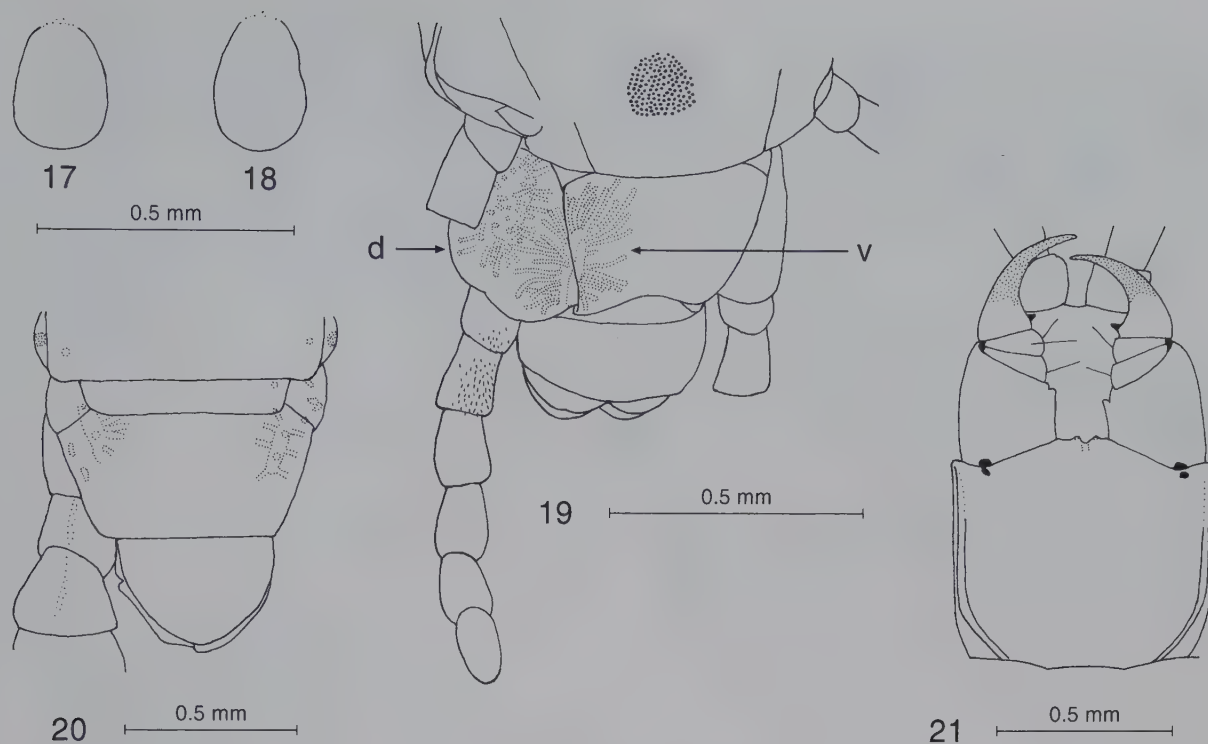
ATTEMS (1947) separated *B. signata* and *B. egyptiaca* on the proportions of the median sternal depressions ("Bauchgruben"). They are circular or oval, never twice as long as wide in *B. signata*, and up to three times as long as wide in *B. egyptiaca*. LEWIS (1986) assigned three specimens from Riyadh to *B. egyptiaca* although the depressions were less than twice as long as wide in these specimens. He suspected that the two species were not distinct. ZAPPAROLI (1991) suggested that the genus *Bothriogaster* contains a single species *B. signata* and that the other taxa described in the genus are probably junior synonyms. This is an eastern Mediterranean genus extending into the Caucasus, Turkestan and Iran.

Polyporogaster tunetana Verhoeff, 1899 (Fig. 20)

Polyporogaster tunetana Verhoeff, 1899. — Zool. Anz. 22: 365.

Material: Saudi Arabia: 1 ♂, 49 mm, 83 pairs of legs, Wadi Awsat, 3.XII.1976, W. Büttiker; 1 ♀, 32 mm, 85 pairs of legs, Wadi Tumair, 27.II.1976, W. Büttiker; 1 ♂, 52 mm, 85 pairs of legs, Wadi Tumeir (= Tumair), 20.II.1976, W. Büttiker; 1 ♀, 76 mm, 87 pairs of legs, Horeimele (= Huraymala), 14.XII.1975, W. Büttiker. — Kuwait: 1 ♀, 51 mm, 85 pairs of legs, Wadi Umm Al-Rumam Farm, 29°33'N 47 42.5 'E, 90 m, 20.II.1988, W. Büttiker.

Remarks: The distribution of the species in the Arabian Peninsula is shown in Fig. 16. It has been previously recorded from Tunisia, Libya and Saudi Arabia. The gland pores on the coxopleura of the last leg-bearing segment, which open into a single dorsal groove-like pit on either



Figs 17-21: 17-19: *Bothriogaster signata*: 17, sternital depression, sternite 38, specimen from Makkah; 18: sternital depression, sternite 39, specimen from Makkah; 19, ventral view of terminal segments, coxopleural pores shown on one side only; 20, *Polyporogaster tunetana*, dorsal view of terminal segments, specimen from Wadi Awsat; 21, *Pachymerium causicum*, ventral view of head and forcipular segment. d = dorsal pore group, v = ventral pore group.

side (Fig. 20), are only seen in well-cleared specimens. A poorly cleared specimen runs down to *Mesocanthus* in ATTEM'S (1929) key as it appears to lack coxopleural gland pores.

Family Oryidae

Orphnaeus meruinus meruinus Attems, 1909

Orphnaeus meruinus Attems, 1909. — *Ergeb. Schwed. Exp. Kilimandjaro* 19: 5, Figs 12-13.

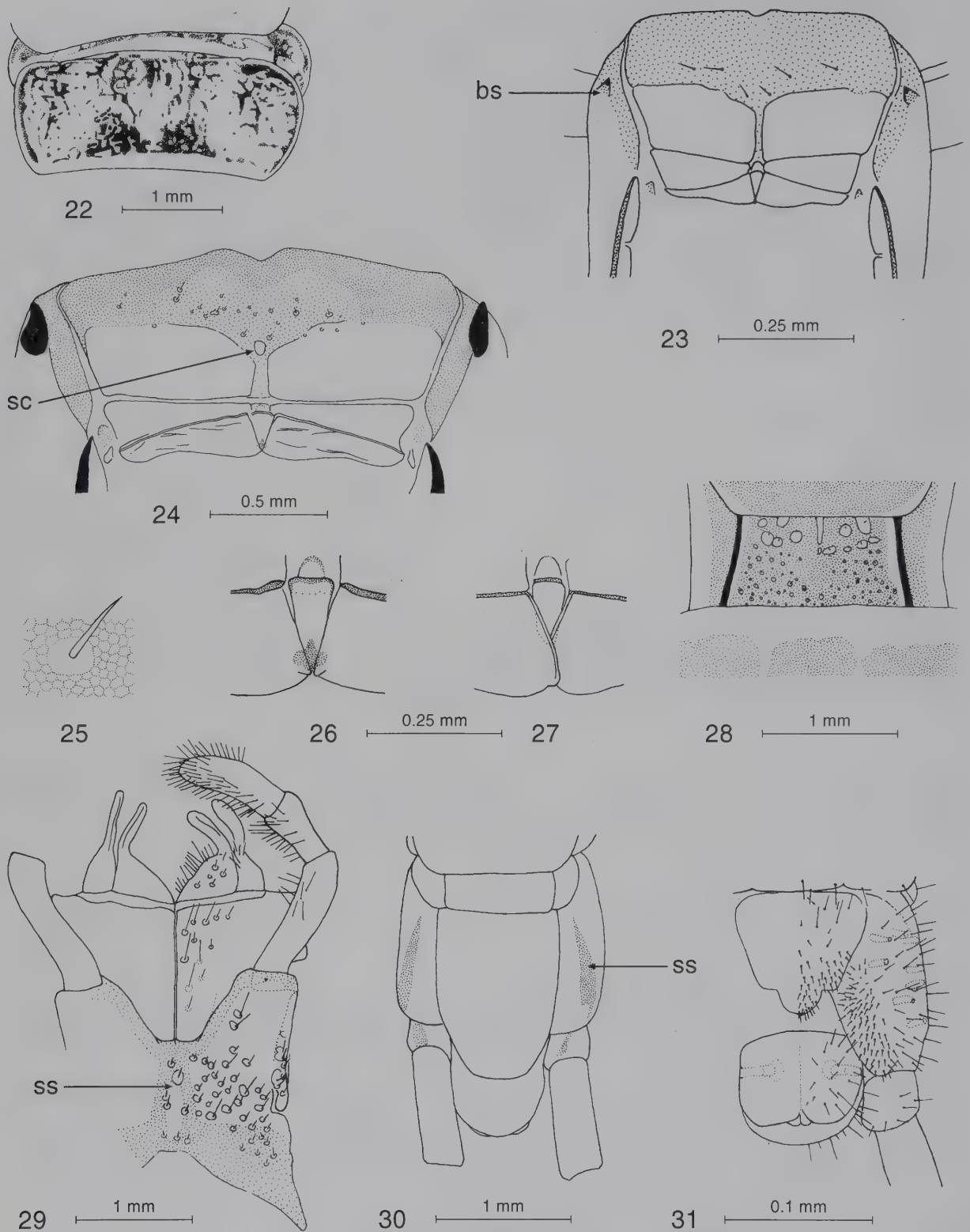
Material: Oman: 1 ♀, 43 mm, 83 pairs of legs, Al-Qibliyah, Kuria Muria Islands, 17°30'N 56°20'E, 28.V.1983, M.D. Gallagher.

Remarks: The distribution of the species on the Arabian Peninsula is shown in Fig. 16. Recorded from Congo, Kenya and Oman it very closely resembles *O. brevilabiatus* which is very widely distributed in the tropics and recorded from South Yemen.

Family Mecistocephalidae

Mecistocephalus insularis (Lucas, 1863) (Figs 22-31)

Geophilus insularis Lucas, 1863. — In: Maillard, *Notes sur l'île de la Réunion (Bourbon)* Edn. 2, T. 2, Annexe N, *Myriapodes*. Pl. 21, Fig. 1.



Figs 22-31: *Mecistocephalus insularis*: 22, tergite 7 of 76 mm ♂, 23, clypeus and labrum of 21 mm immature specimen; 24, clypeus and labrum of 91 mm ♀; 25, clypeal seta of 76 mm ♂; 26, mid-piece of labrum of 91 mm ♀; 27, mid-piece of labrum of 76 mm ♂; 28, basal plate of 91 mm ♀; 29, first and second maxillae of 91 mm ♀; 30, terminal segments of 91 mm ♀, dorsal view; 31, terminal segments of 21 mm immature specimen, ventral view. bs = buccal spiculum, sc = sclerotised cuticle behind posterior geminate setae, ss = sclerotised strip.

Material: Yemen: 1 ♂, 76 mm, 1 ♀, 91 mm, 1 ♀, 49 mm, 1 ♂, 53 mm, Jebel an-Nabi Shuaib, 15°17'N 43°59'E, 16.X.1992, A. van Harten; 1 ♂, 70 mm, 1 imm., 21 mm, 1 ♀, 84 mm, 1 ♀, 51 mm, same locality, 11.IX.1992; 2 ♀♀, 82 and 64 mm, same locality, 17.III.1993; 1 ♂, 35 mm, Dhamar, 13.III.1991, A. van Harten, H. Mahdi, M. Mahyoub.

Remarks: The distribution of the species in the Arabian Peninsula is shown in Fig. 16. The specimens match ATTEMS' (1929) description. The head capsule ratio of length to width varies from 1.77:1 to 1.7:1 but is only 1.54:1 in the smallest specimen. The colour is variable: head capsule reddish-brown, trunk yellowish-brown with dark brown pigment below the cuticle particularly on anterior and posterior segments (Fig. 22) but in some specimens this pigment is reduced or absent.

Anterior clypeus about as wide as the posterior clypeus (prelabral plagula), typically with 2+2 mid clypeal setae in these Yemeni specimens, and a pair of posterior geminate setae (Fig. 23). In the 76 mm ♂ there is only one seta and in the 91 mm ♀ there is a number of small, irregularly arranged, spine-like setae (Fig. 24). In large specimens the setae are set in smooth cuticle (Fig. 25) which may be taken for smooth islands ("glatte Inseln") that ATTEMS (1947) used to separate groups of *Mecistocephalus* species. If they are so regarded then these large specimens run down, incorrectly, to a group of species (*M. meggittii* Verhoeff from Burma, *M. mikado* Attems from Japan and *M. nilgirinus* Chamberlin from India). In larger specimens the central region of the anterior clypeus is more finely areolate (Fig. 24) and in all but the two smallest specimens there is a prominent small area of sclerotised cuticle immediately behind the posterior geminate setae.

The mid-piece of the labrum tapers posteriorly and is overlapped to varying degrees by the side pieces. Distally it is well sclerotised and has a subterminal small hump on each side (Fig. 26). In the 76 mm ♂ the mid-piece is truncated (Fig. 27).

Mandibles: the number of toothplates varies from 7 to 11. The first toothplate may have 5, 6, 7 or 8 teeth. The middle toothplate has from 14 to 28 teeth.

In the immature specimen the buccal spicula are small, pointed and weakly sclerotised (Fig. 23, bs).

The basal plate (Fig. 28) is strongly punctate, the setae set in pale areas of cuticle. There is no clear mid-longitudinal elliptical sulcus.

Forcípules: The poison claw has two rounded denticles at its base in small specimens but these are absent in large specimens.

Second maxilla: The median longitudinal areolate strip has a smooth sclerotised strip in large specimens (Fig. 29, ss).

Tergite 1 is well sclerotised and has a pair of pale lines in the position of the paramedian sutures. Paramedian sutures complete from 2 or 3.

Sternites with rhachides (median longitudinal sutures) from 2. Y-shaped from 2-20, 21 or 22. Simple from 21, 22 or 23 to 34-39. Angle of Y 77-90° on sternite 2, 99-110° on sternite 7. In the immature specimen Y-shaped from 2-18, simple from 19-22.

Last leg-bearing segment with longitudinal sclerotised strip dorsally on coxopleura of large specimens (Fig. 30, ss).

Terminal pores obvious in the two smallest specimens (Fig. 31) but not seen in the other specimens where they are presumably obscured by the gonopods.

These observations on the differences between large and small individuals and on individual variation are of importance as some have been used to differentiate species. In ATTEMS' (1947) key the number of coxal pores (numerous or few), the number of mandibular toothplates, smooth areas on the clypeus, presence or absence of pigment spots under the cuticle, whether the base of the poison claw has a double tooth or not, and the size of the buccal spiculum are all used to distinguish species. Clearly the genus is in urgent need of revision.

Family Geophilidae

Pachymerium caucasicum Attems, 1903 (Fig. 21)

Geophilus (*P.*) *caucasicum* Attems, 1903. — Zool. Jahrb., Syst. 18: 256.

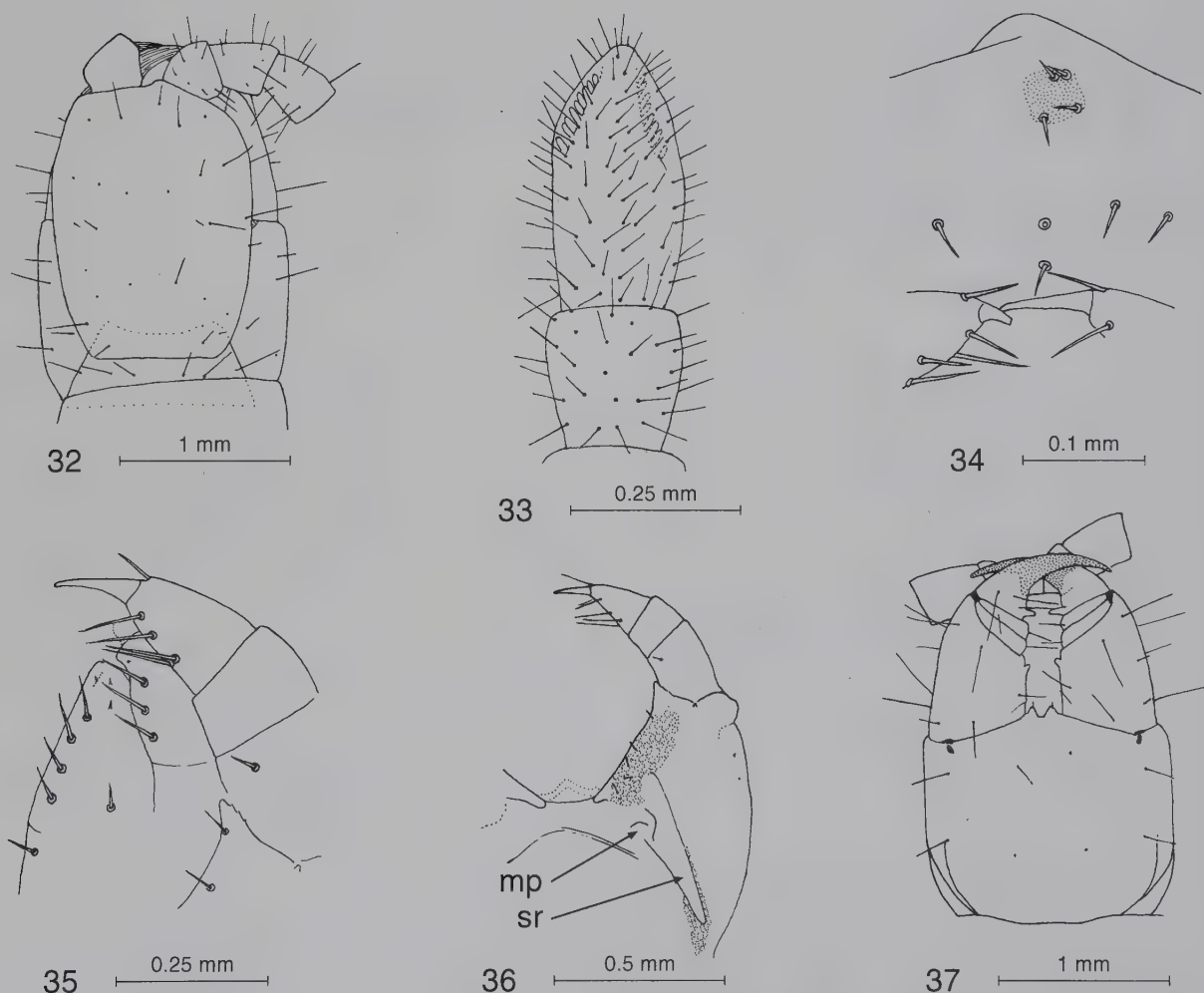
Pachymerium ferrugineum caucasicum Brölemann, 1922. — Proc. Roy. Soc. Edin. 42: 57.

Material: Saudi Arabia: 2 ♀♀, 24 mm, 51 pairs of legs, Bani Sar, 20°06'N 41°26'E, 22.II-7.III.1984, W. Büttiker.

Remarks: This species is differentiated from the widely distributed *Pachymerium ferrugineum* C.L. Koch merely by the absence of chitin lines on the forcipular coxosternum (Fig. 21). It has been recorded from the Caucasus, Iraq and Japan. Its distribution in the Arabian Peninsula is shown in Fig. 16.

Ribautia arabica n. sp. (Figs 32-44)

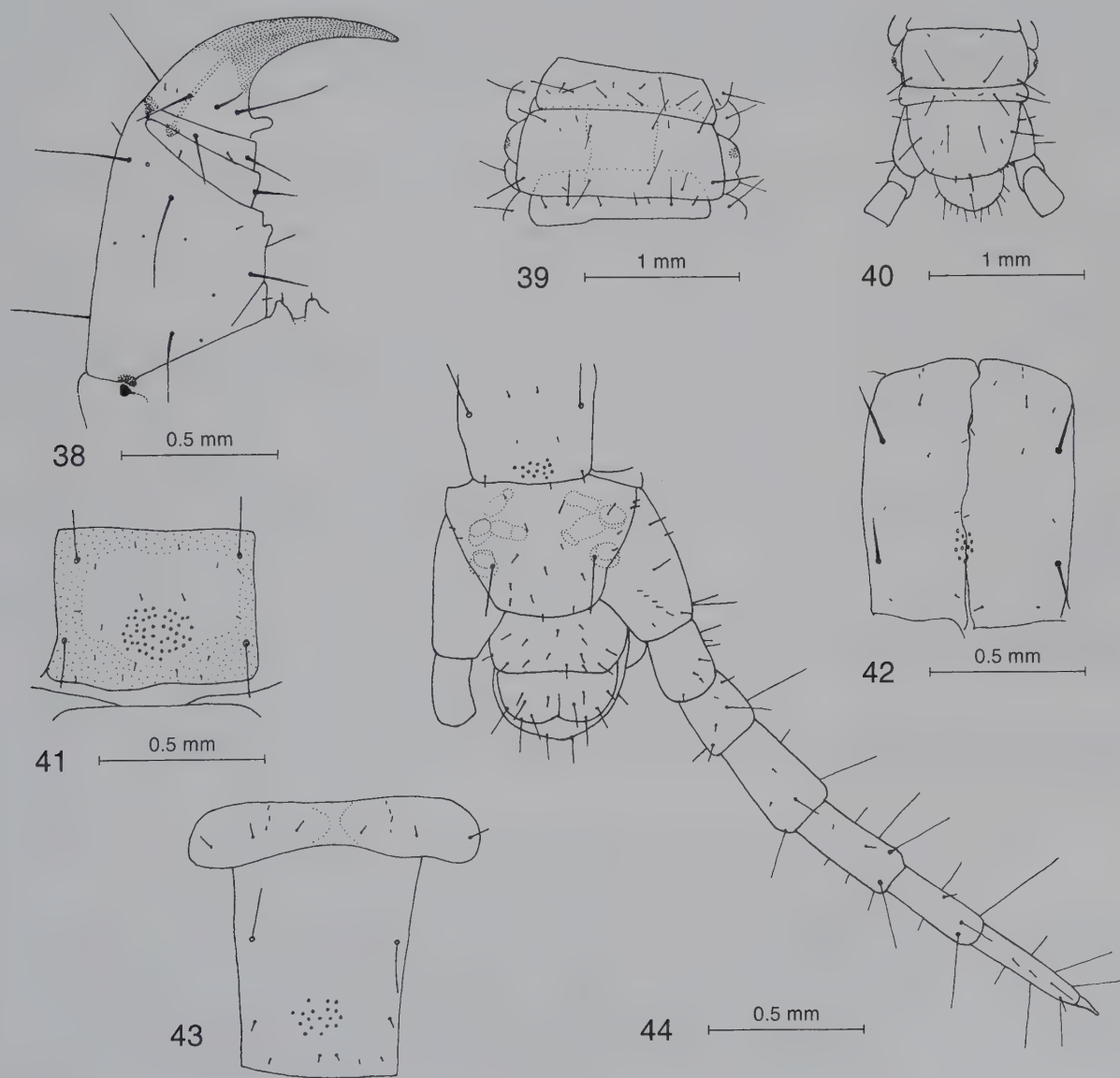
Holotype: ♀, Yemen: Jebel an-Nabi Shuaib, 15°17'N 43°59'E, 16.X.1992, A. van Harten.



Figs 32-37: *Ribautia arabica*: 32, head; 33, terminal two antennomeres; 34, clypeus; 35, palps of first maxilla and telopodite of second maxilla; 36, right half of second maxillae; 37, ventral view of head and forcipular segment, only large setae are shown. mp = metameric pore, sr = sclerotic ridge.

Diagnosis: 45 pairs of legs. First pair of maxillae without palps. Round ventral pore fields from tergite 2 to penultimate one, divided by narrow strip without pores from sternites 17-41. Pores of coxopleura of last pair of legs 4-4, arranged on each side in an anterior group of three and a posterior single pore all opening under the sternite. Claw of last leg well developed. Anal pores absent.

Description: ♀, body length 20.5 mm. 45 pairs of legs. Colour: head brown (henna), trunk greyish-yellow. Antennae 2.3 times as long as the head capsule. Basal antennomeres with sparse, mainly long setae (Fig. 32), the setae gradually increasing in number and reducing in length so that last six antennomeres have setae of uniform length (Fig. 33). Terminal antennomere with inner and outer lateral groups of basiconic sensilla.



Figs 38-44: *Ribautia arabica*: 38, left forcipule; 39, tergite 10; 40, dorsal view terminal segments; 41, sternite 5; 42, sternite 27; 43, sternite 42; 44, ventral view of terminal segments.

Head capsule longer than wide (1.26:1) with hind border straight and lateral edges excurved. Frontal suture absent.

Clypeus: clypeal area finely areolate with four setae. A transverse row of four setae in middle of clypeus and one median seta behind (Fig. 34), others may be obscured by telopodite of second maxillae. Labrum with distinct mid- and side-pieces, details obscured by second maxillae and mandibles.

First maxillae: telopodite of two telomeres, with hyaline apex, without palps (lappets). Median lobes large, conical (Fig. 35).

Second maxillae: coxosterna joined by narrow bridge (Fig. 36). Metameric pores slit-like. Well-developed sclerotic ridge present. Telopodite of three telomeres, apical claw long.

Forcipular segment: coxosternum wider than long, sides converging slightly anteriorly. Chitin lines abbreviated, extending 0.43 of the distance to the articulation of the telopodite (Fig. 37). Coxosternum strongly areolate except for narrow median longitudinal strip and lateral strips. Anterior border with two humps, each bearing a short seta. Telopodite: femuroid with distal tooth or process (Fig. 38), tibia and tarsus without teeth. Poison claw reaching well in front of head with smooth inner edge and strong basal tooth. Poison claw calyx of sub-cordate type, situated as shown.

Tergites sparsely setose, the anterior tergites more than twice as wide as long (Fig. 39). Paramedian sutures present. Pretergites very large. Sternites with four large setae, one towards each corner on anterior sternites (Fig. 41), the more anterior pair set far back and the posterior pair much reduced on posterior sternites (Fig. 43). Anterior sternites about as long as wide, posterior sternites longer than wide. Anterior sternites areolate but this reduces progressively and disappears by sternite 15. Pore fields present on sternites 2-44. Anterior pore fields large and rounded: sternite 5 with 46 pores. Narrow poreless strip from 17-41. Porefields reducing in size on posterior sternites. A central longitudinal fold on sternites 7-40, most marked on middle sternites (Fig. 42): possibly an artefact. Intersternites clearly divided medially to 40.

Last leg-bearing segment: tergite wider than long (Fig. 40). Sternite wider than long, trapeziform (Fig. 44). Each coxopleuron with four glands opening by an anterior group of three and single posterior pore both lying under the sternite. Last pair of legs of seven podomeres with an apical claw.

Female gonopods unsegmented, fused medially. Anal pores absent. Walking legs with well-developed claws, subsidiary claws small.

Table 3: Characteristics of *Ribautia arabica*, *R. sarasini* and *R. pruvotae*.

| | <i>R. arabica</i> | <i>R. sarasini</i> | <i>R. pruvotae</i> |
|-------------------------|-------------------|--------------------|--------------------|
| Length (mm) | 20.5 | 28 | 25 |
| Pairs of legs | 45 | 47 | 55 |
| Pore fields on segments | 2-44 | 1-46 | 1-54 |
| Pore fields divided | 17-41 | 5-46 | 18-54 |
| Coxopleural pores | | | |
| Anterior group | 3 | 5-7 | 10-11 |
| Posterior group | 1 | 5-7 | 9-10 |
| Claw on terminal leg | present | ? | absent |

Remarks: The species of the genus *Ribautia* are very widely distributed having been recorded from South America, West Africa, Madagascar, Australia, New Zealand and New Caledonia. The presence of a species on the Arabian Peninsula is unexpected and suggests that other species remain to be discovered possibly in India and South East Asia.

This new species appears to be related to *R. sarasini* Ribaut (New Caledonia) and *R. pruvotae* Brolemann (Loyalty Island). They are compared in Table 3. The relationships of the known species need to be re-evaluated.

Order Lithobiomorpha

Family Lithobiidae

Among the specimens preserved in the Zoological Museum, Copenhagen, are four female *Lithobius* which have been examined by Dr. E.H. Eason who has contributed the following note.

The specimens agree in all essential characters with ZALESSKAJA's (1978) redescription of *Lithobius cronebergii* Sseliwanoff, 1881, previously recorded only from the Caucasus.

***Lithobius erythrocephalus cronebergii* Sseliwanoff, 1881 n. stat.**

Lithobius cronebergii Sseliwanoff, 1881. — Trudy Russk. ent. Obshch. 12: 185.

Lithobius cronebergii. — Zaleskaja 1978; Classification key of the Lithobiomorpha of the USSR: 139, Pl. 77, Figs 1-5.

Material: Yemen: 3 ♀♀, Sana'a, 1.XII.1991, A. van Harten; 1 ♀, Sana'a × Mabbar near Thibar, 12.III.1992, A. van Harten.

Description: Length: 10-12 mm. Antennal articles: 33-35. Ocelli 1+4, 3, 2. Tergites: posterior angles of T 9 and 11 without projections, those of T 13 with traces of projections. Coxal pores: 4, 5, 5, 4. Gonopod: with acuminate spurs and a tridentate claw as figured by ZALESSKAJA (1978, Pl. 77, Figs 4-5). Spinulation of legs: as in ZALESSKAJA (loc. cit.) but VaC on 14 as well as 15 in two specimens and 15 VaT absent.

Females of this form only differ from those of *Lithobius erythrocephalus* C.L. Koch, a widespread European species, in the shape of the spurs of the gonopod (see EASON 1972: Fig. 2) and should be regarded as a subspecies. A female of this form also in the collection of the Zoological Museum, Copenhagen University, was found near Kalavrita, Greece, 17-19.VI.1982 which shows that its range extends well beyond the Caucasus. Although it appears to be well established in the neighbourhood of Sana'a, it is the only species of *Lithobius* recorded from the Arabian Peninsula, and there is a possibility of artificial introduction.

Thanks are due to Dr. Henrik Enghoff (Copenhagen) for making these specimens available for examination.

ACKNOWLEDGEMENTS

The following people kindly sent me material for examination: Dr. M. Brancucci (Natural History Museum, Basel), Dr. Henrik Enghoff (Zoological Museum, Copenhagen) and Mr. M.D. Gallagher (Oman Natural History Museum, Muscat). I am grateful to Mr. Paul Hillyard for his help during my visits to the Natural History Museum, London. Professor Dr. W. Büttiker and Mr. M.D. Gallagher kindly advised on the location of collecting sites in Saudi Arabia and Oman.

My thanks are also due to Dr. D.J. Stradling and the Royal Society and Association for Science Education Research in Schools Committee for advice, encouragement and support.

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Sitobion asirum, a New Aphid Species from the Asir Area, Saudi Arabia (Homoptera: Aphididae)

Yousif N. Aldryhim and Fernando A. Ilharco

Abstract: A new aphid species, *Sitobion asirum*, is described; it was collected from *Phragmanthera regularis* (Loranthaceae) from the Asir area, Saudi Arabia. The new species is characterised by the following combination of characters: the siphunculi are tapering and pale to dusky and the reticulated area is 10-18 % of the total length of the siphunculus. It forms small colonies on the upper leaf surface of the host plant.

Sitobion asirum نوع جديد من حشرات المن من منطقة عسير والمملكة العربية السعودية
(رتبة متشابهات الأجنحة عائلة المن)

يوسف بن ناصر الدريهم وفرناندو أ. المهركو

خلاصة: في هذا البحث تم وصف النوع *Sitobion asirum* لأول مرة من منطقة عسير في المملكة العربية السعودية. وجمعت افراد هذا النوع من على السطح العلوي لأوراق نبات *Phragmanthera regularis* الذي يتطفل على افرع نباتات *Acacia* sp. وجرى اعتبار شكل وطول وعرض ولون الانابيب البطنية siphunculi من الصفات المميزة لهذا النوع. ووجد ان نسبة طول reticulation إلى طول الانابيب كانت ١٠-١٨٪ وهذه النسبة قليلة مقارنة بالانواع الاخرى القريبة من هذا النوع.

INTRODUCTION

The genus *Sitobion* Mordvilko, 1914, contains 94 described species and subspecies in the world. ALDRYHIM & KHALIL (1996) recorded three *Sitobion* species in Saudi Arabia. They found *S. avenae* (Fabricius) and *S. fragariae* (Walker) from Gramineae and *S. africanum* (Hille Ris Lambers) from *Ficus* sp. The objective of this paper is to describe a new *Sitobion* species occurring on *Phragmanthera regularis* (Loranthaceae).

Sitobion asirum n. sp., Figs 1-2

Holotype: Saudi Arabia: apterous viviparous ♀, Asir, Abha, 18°13'N 42°30'E, 3300 m, 7.IV.1994. — **Paratypes** (same locality as holotype): 6 apterous viviparous ♀♀, 7.IV.1994; 1 apterous ♀, 25.V.1992; 1 apterous viviparous ♀, 20.IV.1993; 3 alate viviparous ♀♀, 26.X.1994. — **Non-type material** (same locality as holotype): 1 alate viviparous ♀, 7.IV.1994; 6 apterous nymphs, 7.IV.1992; 5 apterous nymphs, 23.V.1992; 4 alate nymphs, 23.V.1992. All the studied specimens are kept in the Plant Protection Department, King Saud University.

Description: Apterous viviparous ♀: Specimens are green with pale appendages, except for the articulations of antennal segment III-IV, IV-V, V-VI, all of VI and tarsal segments which are dusky. Siphunculi from pale (with dark apex) to dusky. They form small colonies mainly on the upper leaf surface of the host plant.

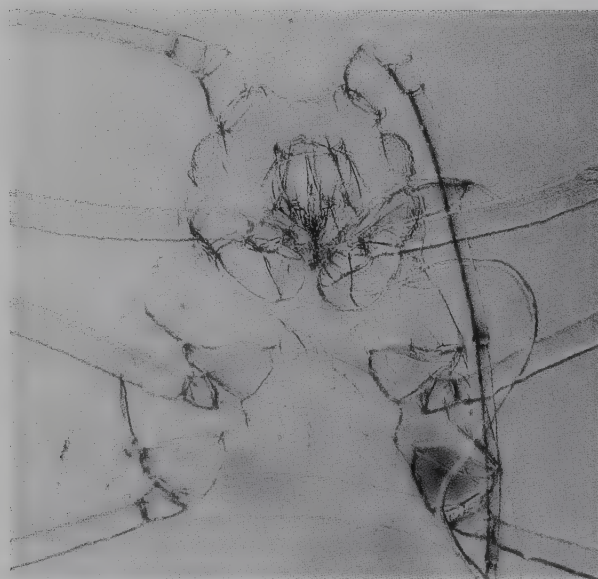


Fig. 1: Anterior part of holotype of *Sitobion asirum* n. sp.



Fig. 2: Posterior part of holotype of *Sitobion asirum* n. sp.

Body length 1.68-1.98 mm, including cauda. Antennal tubercles moderately developed with median frontal tubercle prominence. Frontal hairs short, inconspicuous (6.25-8.25 μ m). Cephalic hairs (anterior, middle and posterior) almost equal in length (6.25-8.74 μ m). Antennae 1.05-1.25 times as long as body. Unguis 5.07-6.0 times as long as basal part of segment VI, 1.35-1.72 times as long as segment III. Third antennal segment 0.97-1.18 times as long as segment IV, with 0-2 secondary rhinaria, with 11-27 short hairs (6.25-8.70 μ m). Eyes large, ocular tubercle prominent. Rostrum short, reaching the third coxae, ultimate rostral segment with 4-6 secondary hairs (17.5-25.0 μ m), 0.9-1.2 times as long as second segment of hind tarsi. First tarsal joints with 3, 3 and 3 hairs. Genital plate with two primary hairs (20-25 μ m), 9-13 marginal hairs (18-25 μ m) and 0-1 supplementary ones (17.50-21.25 μ m). Tergite VIII with 3-4 hairs (7.5-12.5 μ m), usually four hairs. Siphunculi tapering gradually, 0.20-0.27 times as long as body, 1.56-1.86 times as long as cauda, 0.89-1.05 times as long as the third antennal segment, their middle diameter 1.50-1.66 times as broad as middle diameter of hind tibiae, with 4-7 rows of reticulations. The reticulated area 10-18 % of total length of siphunculus. Caudal hairs 6-8, with 4-5 long hairs (41-50 μ m) implanted laterally and 2-3 apical short hairs (16-31.25 μ m) implanted dorsally.

Alate viviparous ♀: The specimen was collected from the upper leaf surface of the host plant. It is pale green with dark antennae and siphunculi. Body length 1.56-1.76 mm, including cauda. Third antennal segment 0.41-0.45 mm long with 6-9 secondary rhinaria. Dorsal cephalic hairs very short (7-9 μ m). Rostrum short, reaching the second coxae. Ultimate rostral segment 0.10-0.11 mm, with 4-5 secondary hairs, equal to second segment of hind tarsi. Siphunculi 0.37-0.40 mm long. Cauda 0.20-0.22 mm long with 7-8 long hairs (41-44 μ m). Genital plate with two primary hairs, 1-3 supplementary hairs (10-14 μ m) and 9-11 marginal hairs (13-20 μ m). Tergite VIII with 3-4 hairs (10-18 μ m).

Nymphs: Nymphs are green and similar to adults. However, the third antennal segment is shorter than the fourth in the third and fourth nymphal instars of apterous and alate morphs.

Host plant: The host plant, *Phragmanthera regularis* (Loranthaceae), is a parasite on the branches of *Acacia* sp. The host is very widespread in the Asir area. For more information on the host plant see COLLENETTE (1985) and GILBERT (1989).

Etymology: *Sitobion asirum* is named after Asir, the area where the samples were collected. Asir is a mountainous area located in south-west Saudi Arabia, with elevations of over 3000 m to the south, covered with dense vegetation and receiving monsoon rain.

Table 1: Biometric data (in mm) for *Sitobion asirum* n. sp.

Specimen numbers: 1 = apterous viviparous ♀ (holotype), 2-9 = apterous viviparous ♀♀ (paratypes), 10-13 = alate viviparous ♀♀ (paratypes); Siph = siphunculi, URS = ultimate rostral segment, HT2 = second segment of hind tarsi, RH = secondary rhinaria of third antennal segment.

| Specimen No. | Body length | Total | Antennal segments | | | | Cauda | Siph | URS | HT2 | RH |
|--------------|-------------|-------|-------------------|------|------|-------------|-------|------|------|------|-------|
| | | | III | IV | V | VI | | | | | |
| 1 | 1.74 | 2.16 | 0.48 | 0.40 | 0.33 | 0.12 + 0.69 | 0.24 | 0.43 | 0.10 | 0.11 | 1 + 2 |
| 2 | 1.68 | 1.79 | 0.38 | 0.32 | 0.27 | 0.10 + 0.60 | 0.24 | 0.40 | 0.10 | 0.11 | 1 + 2 |
| 3 | 1.98 | 2.09 | 0.43 | 0.44 | 0.32 | 0.12 + 0.65 | 0.25 | 0.40 | 0.10 | 0.10 | 1 + 1 |
| 4 | 1.73 | 2.02 | 0.45 | 0.43 | 0.30 | 0.12 + 0.61 | 0.23 | 0.43 | 0.09 | 0.10 | 1 + 1 |
| 5 | 1.85 | 2.14 | 0.46 | 0.41 | 0.34 | 0.14 + 0.65 | 0.28 | 0.45 | 0.11 | 0.11 | 0 + 0 |
| 6 | 1.75 | 2.17 | 0.48 | 0.44 | 0.34 | 0.13 + 0.66 | 0.28 | 0.48 | 0.11 | 0.12 | 1 + 2 |
| 7 | 1.69 | 2.12 | 0.46 | 0.39 | 0.34 | 0.13 + 0.69 | 0.24 | 0.44 | 0.10 | 0.10 | 1 + 1 |
| 8 | 1.75 | 1.92 | 0.40 | 0.34 | 0.28 | 0.11 + 0.65 | 0.25 | 0.39 | 0.10 | 0.10 | 1 + 1 |
| 9 | 1.88 | 2.20 | 0.43 | 0.43 | 0.35 | 0.13 + 0.74 | 0.25 | 0.44 | 0.12 | 0.10 | 1 + 1 |
| 10 | 1.65 | - | 0.45 | - | - | - | 0.20 | 0.40 | 0.11 | 0.11 | 8 + 9 |
| 11 | 1.56 | 2.11 | 0.41 | 0.38 | 0.34 | 0.11 + 0.72 | 0.20 | 0.37 | 0.10 | 0.11 | 7 + 8 |
| 12 | 1.68 | 2.20 | 0.45 | 0.40 | 0.33 | 0.12 + 0.75 | 0.22 | 0.37 | 0.11 | 0.11 | 6 + 6 |
| 13 | 1.76 | 2.22 | 0.45 | 0.43 | 0.35 | 0.12 + 0.72 | 0.20 | 0.38 | 0.11 | 0.11 | 7 + 8 |

DISCUSSION

Sitobion asirum is the second *Sitobion* species to be recorded from Loranthaceae. A new species of *Sitobion* from Angola, living on several species of *Loranthus*, which is presently being described by van Harten, can be separated from *S. asirum* by its thicker, darker and longer siphunculi (0.64-0.96 mm), longer body (1.70-2.70 mm), longer unguis (0.83-1.00 mm) and longer last rostral segment (0.119-0.142 mm).

S. asirum is similar to *S. yongyooti* (Robinson, 1972) from an unknown host in Thailand. However, *S. yongyooti* has very thick siphunculi, long unguis (0.7-1.00 mm) and very long reticulated (40 % of siphuncular length).

The length ratio of the third to the fourth antennal segments of third and fourth nymphal instars is a distinctive feature of *S. asirum*, the third antennal segment being shorter than the fourth. This finding contrasts with the nymphs and adults of *Sitobion* in which the third antennal segment is longer than the fourth antennal segment. LYKOURESSIS (1983) found that the third antennal segment was longer than the fourth in the third and fourth nymphal instars of *S. avenae*.

ACKNOWLEDGEMENT

We are very grateful to Dr. A. van Harten, German Biological Control Project, South Pacific Commission, Sava, Fiji, for the communication of his work on a new *Sitobion* species from Angola.

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The Aphididae of Saudi Arabia

Yousif N. Aldryhim and Amin F. Khalil

Abstract: Aphids were collected from colonies during a number of surveys carried out between October 1988 and April 1995, mainly in the Riyadh, Asir, Tabuk and Jizan areas. Sixty-one aphid species and subspecies were recorded from 30 genera representing four subfamilies. Six species represented new records for the Arabian Peninsula and sixteen species were recorded for the first time in Saudi Arabia. The most common species were *Aphis gossypii* Glover, *A. craccivora* Koch, *Myzus persicae* (Sulzer) and *Macrosiphum euphorbiae* (Thomas). The most common aphid hosts were species of Poaceae (Gramineae), Fabaceae, Asteraceae and Solanaceae. The host plant species was infested with one to seven aphid species. *Triticum aestivum* was infested by seven aphid species.

الحشرات من عائلة المن في المملكة العربية السعودية

يوسف بن ناصر الدريهم وأمين فضل خليل

خلاصة: أجريت هذه الدراسة بهدف التعرف على أنواع حشرات المن على مختلف العوائل النباتية في المملكة العربية السعودية خلال الفترة من أكتوبر ١٩٨٨م إلى إبريل ١٩٩٥م حيث تم جمع العينات بدرجة رئيسية من المناطق التالية: - الرياض، عسير، جيزان وتبوك. كما جمعت بعض العينات من مناطق القصيم وحائل والطائف. تم تعريف ٦١ نوعاً من حشرات المن تتبع ٣٠ جنس وتمثل أربعة تحت عوائل، منها ستة أنواع تسجل لأول مرة في شبه الجزيرة العربية و١٦ نوعاً تسجل للمرة الأولى في المملكة. وتم تسجيل ١٣٨ عائل نباتي لحشرات المن تنتمي إلى ٤٧ فصيلة نباتية. وقد وجد أن حشرة من البطيخ *Aphis gossypii* كانت أكثر حشرات المن انتشاراً في المناطق التي تم مسحها، تليها حشرات من الخوخ *Myzus persicae* ومن البقول *Aphis craccivora* ومن الزهور *Macrosiphum euphorbiae* ومن النجيليات *Rhopalosiphum maidis*. كما وجد أن الكثافة العددية لحشرات المن تزداد خلال الفترة من فبراير إلى نهاية إبريل من كل عام. ويتراوح عدد حشرات المن التي تصيب النبات العائل من ١-٧ أنواع، وأن نباتات القمح *Triticum aestivum* كانت أكثر إصابة بالأنواع المختلفة من حشرات المن حيث سجل عليها سبع أنواع، يليه نباتات الشعير حيث سجل عليها ستة أنواع، ثم دوار الشمس والخبث والمواالح حيث سجل على كل منها خمسة أنواع من حشرات المن.

INTRODUCTION

Aphids are small, soft-bodied insects (1.0-6.0 mm long) belonging to the Family Aphididae. Some species feed on roots but most suck sap from the leaves, stems and buds of green plants (BORROR et al. 1981). Aphids have winged (alate) and wingless (apterous) morphs, sexual and asexual morphs, within the life cycle of a single species. More details on their form and biology have been discussed by KENNEDY & STROYAN (1959), LEES (1966), BLACKMAN (1974), DIXON (1977) and MORAN (1992). Aphids occur throughout the world where approximately 4000 extant species have been recorded (EASTOP 1977). However, relatively little attention has been given to aphid studies in the Arab world. Eighty species have been recorded from Jordan (MUSTAFA 1985, 1986, 1988 a, 1988 b,

1989) and Egypt (HABIB & EL-KADY 1961). Ninety species have been reported from Iraq (AL-ALI 1977) and forty-seven species from Yemen (ERDELEN 1987). HUSSEIN & KAWAR (1984) surveyed 15 species on commercial plants in southern Lebanon and MÜLLER et al. (1977) recorded twenty-five species from Sudan. Aphids in Saudi Arabia have been mentioned in general texts (TALHOUK 1957, 1982; SHALABY 1961; ABU-THURAYA 1982) and MARTIN (1972) recorded 18 species.

The systematic and taxonomic studies of aphids are so important that a comprehensive review of them in the Kingdom is long overdue. The identity of the aphid complex occurring on plants has not been described. Moreover, the realisation of the importance of aphids as vectors of plant viruses has brought a keen demand for an accurate identification of the different aphid species. The present work aims to provide a key for the species occurring in Saudi Arabia, with a short species description and a list of the known range of their host plants.

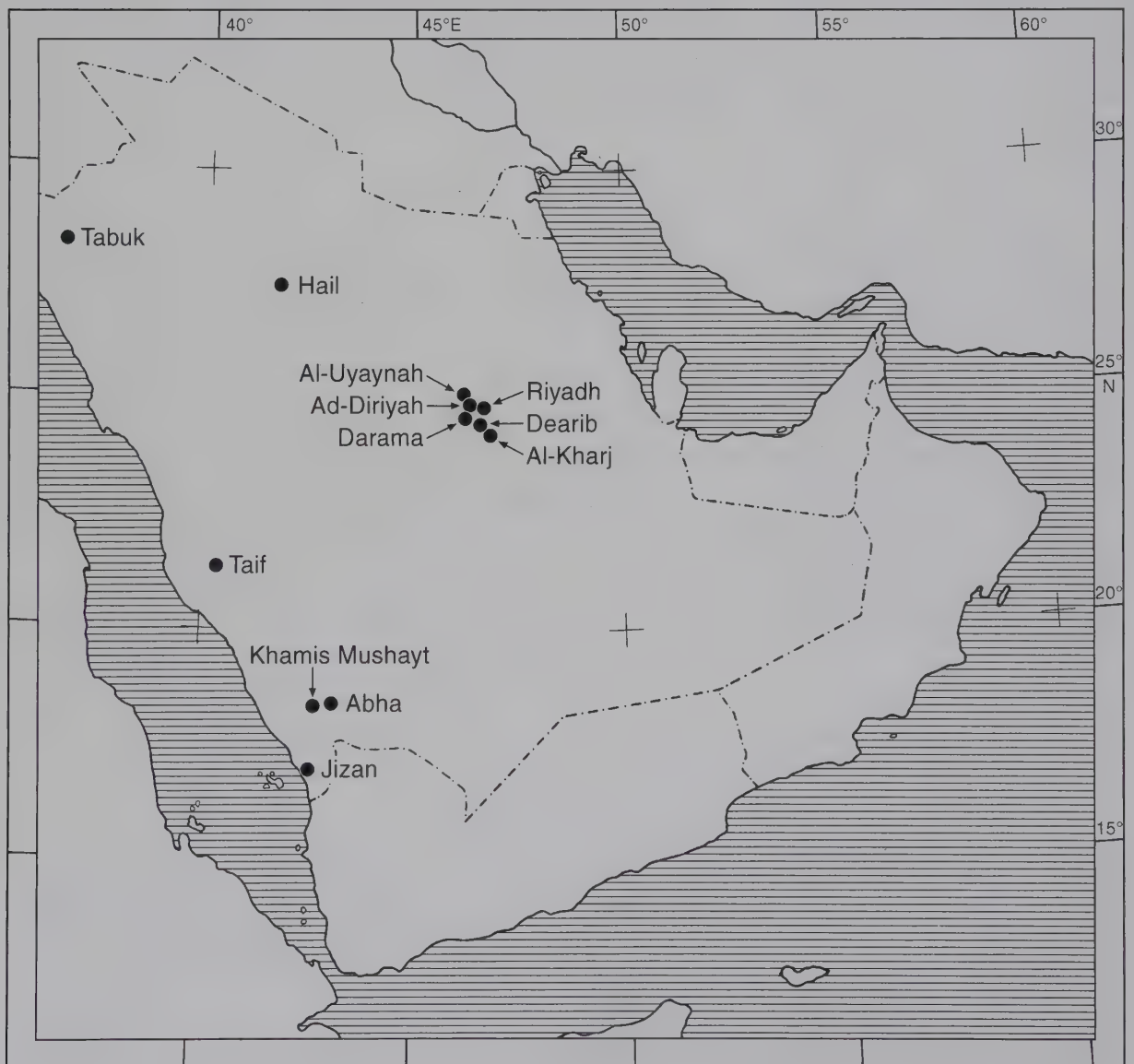


Fig. 1: Map showing sampling sites in Saudi Arabia.

MATERIALS AND METHODS

The present study was carried out between October 1988 and April 1995. Aphid samples were collected from the Riyadh (Riyadh city, Darama, Dearib, Ad-Diriyah), Al-Kharj, Al-Uyaynah, Al-Dawadmy, Asir (Abha, Khamis Mushayt and Suda), Jizan and Tabuk areas. A few samples were also collected from Najran, Taif, Qasim, Hail and Dammam (Fig. 1). About 500 aphid samples were collected from naturally occurring colonies on cultivated and wild plants. Infested plant parts (leaves, stems and roots) were detached and kept in plastic bags. Field notes such as date, plant name, locality, aphid colour and ant attendance were recorded. Specimens from the same colony were preserved together in 75 % alcohol. Four adults from each sample were mounted singly on microscope slides. Species were identified using several sources of taxonomic literature, principally: BLACKMAN & EASTOP (1984), COTTIER (1953), EASTOP (1961, 1971, 1985), HABIB & EL-KADY (1961), HEIE (1986), KONO & PAPP (1977), MEDLER & GHOSH (1969), MORDVILKO (1922), PALMER (1952), STOETZEL (1987) and STROYAN (1961, 1977, 1982, 1984). Furthermore, aphids which could not be identified satisfactorily were submitted to specialists for confirmation or correction of the identifications. EASTOP & HILLE RIS LAMBERS (1976) was used for determining synonyms. The materials from this study are kept in the Plant Protection Department, College of Agriculture, King Saud University.

RESULTS

List of the Arabian Aphids

Subfamily Aphidinae

Tribe Aphidini

- Aphis affinis* del Guercio, 1911
- Aphis (Protophis) armoraciae* Cowen, 1895
- Aphis craccivora* Koch, 1854
- Aphis fabae fabae* Scopoli, 1763
- Aphis fabae solanella* Theobald, 1914
- Aphis gossypii* Glover, 1877
- Aphis hillerislamberti* Nieto & Mier, 1976
- Aphis nasturtii* Kaltenbach, 1843
- Aphis nerii* Boyer de Fonscolombe, 1841
- Aphis punicae* Passerini, 1863
- Aphis spiraecola* Patch, 1914
- Aphis ?urticata* Gmelin, 1970
- Brachyunguis harmalae* Das, 1918
- Brachyunguis tamaricis* (Lichtenstein, 1885)
- Hyalopterus amygdali* (Blanchard, 1840)
- Hyalopterus pruni* (Geoffroy, 1762)
- Hysteroneura setariae* (Thomas, 1878)
- Melanaphis sacchari* (Zehntner, 1897)
- Paraschizaphis rosazevedoi* Ilharco, 1961
- Rhopalosiphum maidis* (Fitch, 1856)
- Rhopalosiphum padi* (Linnaeus, 1758)
- Rhopalosiphum rufiabdominalis* (Sasaki, 1899)
- Schizaphis graminum* (Rondani, 1852)
- Schizaphis rotundiventris* (Signoret, 1860)

Subfamily Aphidinae

Tribe Macrosiphini

- Acyrtosiphon gossypii* Mordvilko, 1914

- Acyrtosiphon kondoi* Shinji, 1938
- Acyrtosiphon lactucae* (Passerini, 1860)
- Acyrtosiphon pisum* (Harris, 1776)
- Aulacorthum solani* (Kaltenbach, 1843)
- Brachycaudus helichrysi* (Kaltenbach, 1843)
- Brachycaudus rumexicolens* (Patch, 1917)
- Brevicoryne brassicae* (Linnaeus, 1758)
- Cavariella aegopodii* (Scopoli, 1763)
- Dysaphis apiifolia* (Theobald, 1922)
- Dysaphis emicis* (Mimeur, 1935)
- Dysaphis foeniculus* (Theobald, 1922)
- Hyadaphis coriandri* (Das, 1918)
- Hyperomyzus lactucae* (Linnaeus, 1758)
- Lipaphis erysimi* (Kaltenbach, 1843)
- Macrosiphum euphorbiae* (Thomas, 1878)
- Macrosiphum rosae* (Linnaeus, 1758)
- Metopolophium dirhodum* (Walker, 1848)
- Metopolophium festucae cerealium* Stroyan, 1982
- Myzus ornatus* Laing, 1932
- Myzus persicae* (Sulzer, 1776)
- Nasonovia ribis-nigri* (Mosley, 1841)
- Ovatus crataegarius* (Walker, 1850)
- Pseudaphis* sp.
- Rhodobium porosum* (Sanderson, 1900)
- Sitobion africanum* (Hille Ris Lambers, 1954)
- Sitobion asirum* Aldryhim & Ilharco, 1996
- Sitobion avenae* (Fabricius, 1775)
- Sitobion fragariae* (Walker, 1848)
- Uroleucon compositae* (Theobald, 1915)

Uroleucon jaceae (Linnaeus, 1758)
Uroleucon sonchi (Linnaeus, 1767)
 Subfamily **Drepanosiphinae**
 Tribe **Phyllaphidini**
Therioaphis trifolii (Buckton, 1899)
 Tribe **Saltusaphidini**
Saltusaphis scirpus Theobald, 1915

Subfamily **Lachninae**
 Tribe **Lachnini**
Cinara maghrebica Mimeur, 1934
Pterochloroides persicae (Cholodkovsky, 1899)
 Subfamily **Pemphiginae**
 Tribe **Eriosomatini**
Eriosoma lanigerum (Hausmann, 1802)

TERMINOLOGY AND MORPHOLOGY

The morphological study was restricted mainly to species found during this investigation. For more details of aphid morphology see ILHARCO & VAN HARTEN (1987). Figure 2 shows the morphological features of an aphid.

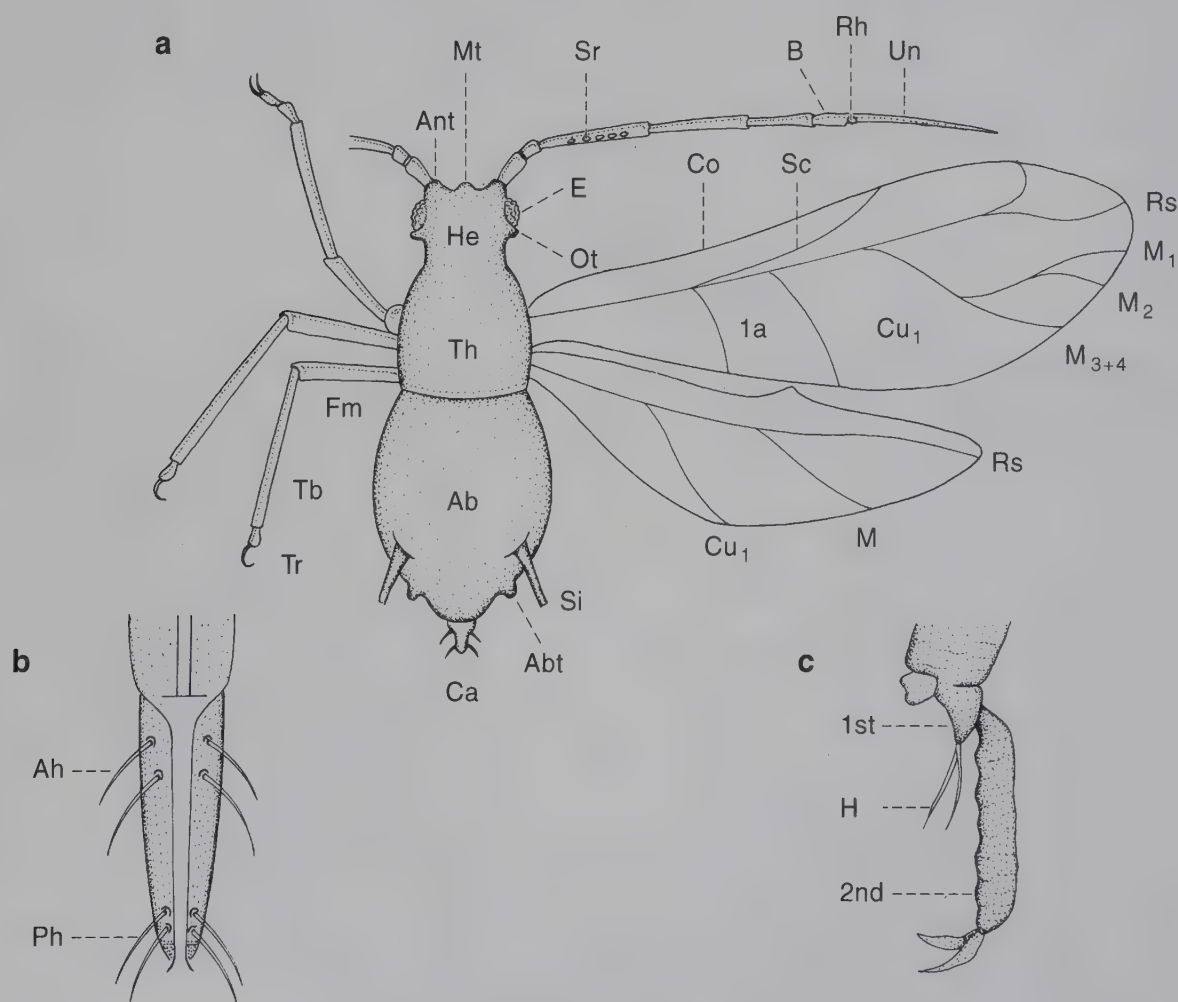


Fig. 2: Outline sketch of a theoretical aphid showing morphological features: a, dorsal view of alate viviparous female: 1 a = first anal fork, Ab = abdomen, Abt = abdominal tubercles, Ant = antennal tubercle, B = basal part of fourth antennal segment, Ca = cauda, Co = costa, Cu = cubitus, E = eye, Fm = femur, He = head, M = media, Mt = median frontal tubercle, Ot = ocular tubercle, Rh = primary rhinaria, Rs = radial sector, Si = siphunculus, Sc = subcosta, Sr = secondary rhinaria, Tb = tibia, Th = Thorax, Tr = tarsus, Un = unguis. b, rostrum: Ah = accessory hair, Ph = primary hair. c, tarsus: H = Hair.

Head

The head bears a flat or convex front with or without paired tubercles at the bases of the antennae. These antennal tubercles may be undeveloped or developed (converging or diverging, see Fig. 3). The last antennal segment is usually composed of a thick basal portion and a slender terminal portion. The former is called the base and the latter is known as the unguis or terminal process (Fig. 2). The ratio of the length of the unguis to the basal part of the last antennal segment is often used as a key character. A primary sensorium is located between the base and the unguis. Secondary rhinaria are often present on the third antennal segment of some apterous morphs.

Thorax

The tarsi are usually in two segments. The second segment is much longer than the first one (Fig. 2 c). The number of hairs on the first tarsal segment is a useful taxonomic character. In the alate morph, the fore wings are larger than the hind wings. The fore wing with one or two medial forks, two forks in most species (Fig. 2). The hind wing has two oblique veins, very rarely only one.

Abdomen

The abdomen consists of eight visible segments, often bearing a pair of siphunculi (cornicles) arising from the tergite of segment V or VI (Fig. 2). They are usually elongated but may be reduced to mere rings (pore-shaped). The siphunculi may be smooth, imbricated or reticulated (Fig. 4). The abdomen of an aphid terminates in a tail-like structure known as the cauda. The cauda may be of various sizes and shapes (Fig. 5), but is most commonly tongue-shaped. The cauda may be covered with a few or many setae. The siphunculi and cauda are of great importance in species identification. Lateral abdominal tubercles occur on various segments, their presence on segments I and VII is a characteristic of the Aphidini (Fig. 2).

Key to Saudi Arabian species of aphids

Apterous viviparous females

- | | | |
|---|---------------------------------------------------------------------------------------------------------------------|---------------------------------|
| 1 | Eighth abdominal tergite with posteriorly projecting supracaudal process (Fig. 5 a) | |
| | | <i>Cavariella aegopodii</i> |
| – | No supracaudal process. | 2 |
| 2 | Cauda knobbed in dorsal view; anal plate bilobed (Fig. 5 b) | 3 |
| – | Cauda rounded, helmet-shaped, pentagonal, triangular or tongue-like in dorsal view (Figs 5 c-f) | 4 |
| 3 | On <i>Medicago sativa</i> ; abdominal tergites 1-5 each with eight long capitate hairs arising from large tubercles | <i>Therioaphis trifolii</i> |
| – | On <i>Cyperus</i> sp.; abdominal tergites without capitate hairs | <i>Saltusaphis scirpus</i> |
| 4 | Siphunculi mere pores (rings) (Fig. 4 a) | <i>Eriosoma lanigerum</i> |
| – | Siphunculi not mere pores (Figs 4 b-h) | 5 |
| 5 | Siphunculi hairy cones (Fig. 4 b) | 6 |
| – | Siphunculi tube-like (Figs 4 c-h) | 7 |
| 6 | On <i>Prunus</i> sp.; body length more than 3.5 mm; apex of rostrum blunt, with dorsal hairs numerous | <i>Pterochloroides persicae</i> |
| – | On <i>Pinus</i> sp.; body length less than 3.5 mm | <i>Cinara maghrebica</i> |

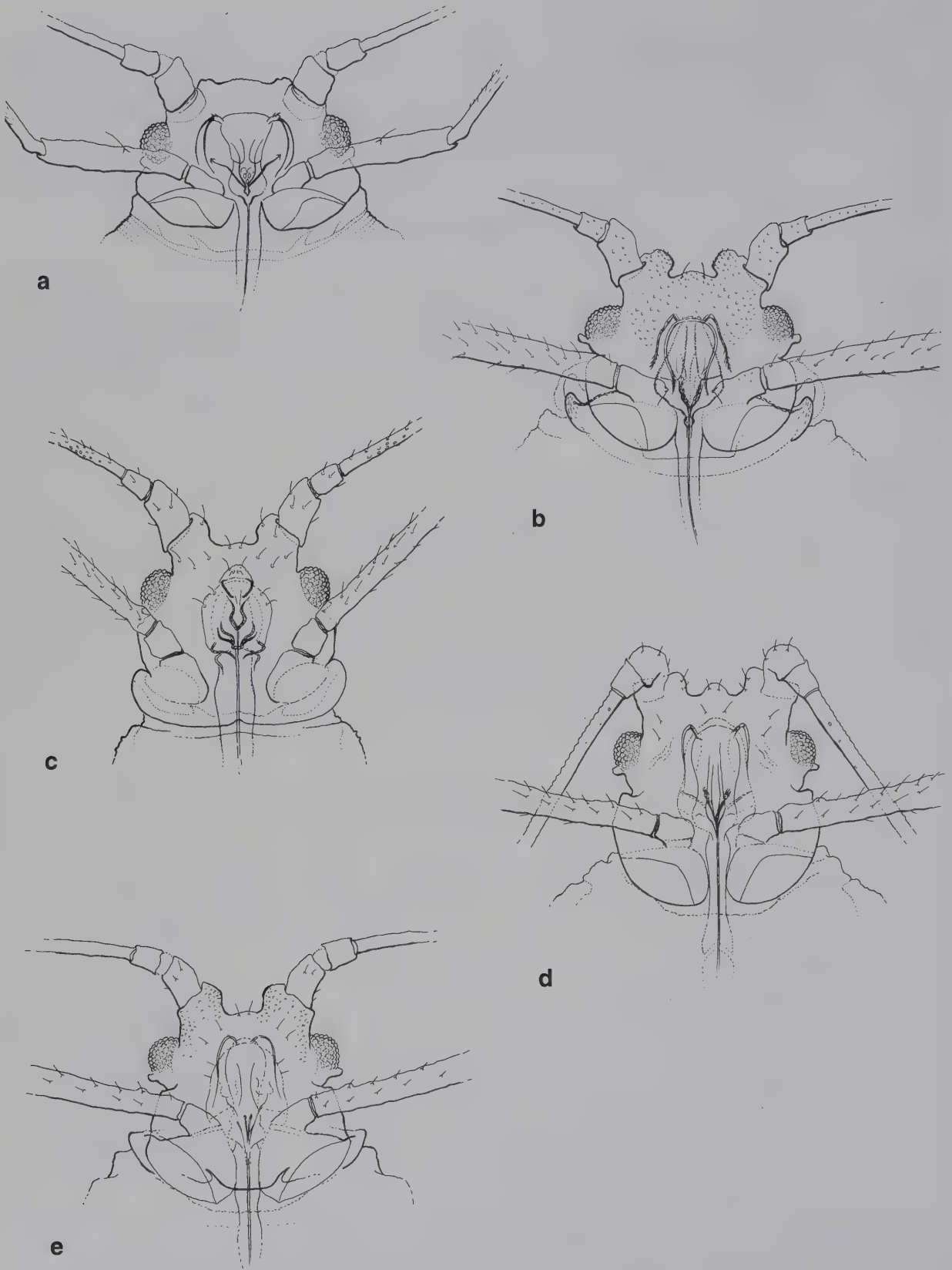


Fig. 3: Antennal tubercles of Arabian aphids: a, undeveloped, *Aphis gossypii*; b, convergent, *Myzus persicae*; c, divergent, *Macrosiphum euphorbiae*; d, divergent with median frontal tubercles, *Metopolophium dirhodum*; e, parallel, *Aulacorthum solani*.

| | | |
|----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| 7 | Unguis shorter than base of last antennal segment | 8 |
| – | Unguis longer than base of last antennal segment | 9 |
| 8 | Siphunculi 0.8-0.9 times as long as third antennal segment, longer than cauda <i>Brachyunguis tamaricis</i> | |
| – | Siphunculi 0.3-0.4 times as long as third antennal segment, shorter than cauda <i>Brachyunguis harmalae</i> | |
| 9 | Cauda rounded, helmet-shaped or pentagonal (Figs 5 c, d) | 10 |
| – | Cauda triangular (Fig. 5 e) or tongue-shaped (Fig. 5 f) | 14 |
| 10 | Cauda rounded at apex (Fig. 5 c) | 11 |
| – | Cauda with angular apex (Fig. 5 d) | 12 |
| 11 | Siphunculi very short, about as long as their basal width <i>Brachycaudus rumexicolens</i> | |
| – | Siphunculi short, at least twice as long as their basal width <i>Brachycaudus helichrysi</i> | |
| 12 | Antennal hairs long and conspicuous, longer than the basal diameter of third antennal segment <i>Dysaphis emicis</i> | |
| – | Antennal hairs short, shorter than the basal diameter of third antennal segment | 13 |
| 13 | Siphunculi 2-3 times longer than their basal width <i>Dysaphis apiifolia</i> | |
| – | Siphunculi less than 2 times longer than their basal width <i>Dysaphis foeniculus</i> | |
| 14 | On Brassicaceae; cauda triangular (Fig. 5 e); third antennal segments without secondary rhinaria <i>Brevicoryne brassicae</i> | |
| – | On Brassicaceae and on other plants; cauda tongue-like (Fig. 5 f) or broad; if broad then third antennal segments with secondary rhinaria | 15 |
| 15 | Antennal tubercles poorly developed or absent (Fig. 3 a); spiracles of abdominal segments I and II are not close to each other, lateral abdominal tubercles present on segments I and VII; antennae shorter than body, usually without secondary rhinaria; siphunculi without reticulation | 16 |
| – | Antennal tubercles often well developed (Figs 3 b-e); spiracles of abdominal segments I and II are close to each other; lateral abdominal tubercles usually absent on segments I and VII; antennae shorter or longer than body, usually with secondary rhinaria; siphunculi with or without reticulation | 34 |
| 16 | Third and fourth antennal segments of apterae with secondary rhinaria <i>Aphis armoraciae</i> | |
| – | Third and fourth antennal segments of apterae without secondary rhinaria or with 1-2 on the third antennal segment | 17 |
| 17 | Siphunculi shorter than cauda | 18 |
| – | Siphunculi longer than cauda | 20 |
| 18 | Unguis less than twice as long as basal part of last antennal segment; cauda twice as long as siphunculi <i>Aphis hillerislambersi</i> | |
| – | Unguis more than twice as long as basal part of last antennal segment; cauda less than twice as long as siphunculi | 19 |
| 19 | On <i>Prunus</i> sp.; body rather elongate; cauda with less than six hairs <i>Hyalopterus</i> sp. | |
| – | On Poaceae; body rather ovate; cauda with more than six hairs <i>Melanaphis sacchari</i> | |
| 20 | Lateral abdominal tubercles of 7th tergite placed more ventrally than spiracle of that segment (Fig. 6 b) | 21 |

| | | |
|----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|
| – | Lateral abdominal tubercles of 7th tergite placed more dorsally than spiracle of that segment (Fig. 6 a) | 28 |
| 21 | On Asclepiadaceae; yellow aphids with black cauda and siphunculi; first segment of hind tarsus with three hairs | <i>Aphis nerii</i> |
| – | Green to black aphids; first segment of hind tarsus with two hairs | 22 |
| 22 | Dorsal abdomen with an extensive solid black patch; dark cauda | <i>Aphis craccivora</i> |
| – | Dorsal abdomen without central patch; pale or dark cauda | 23 |
| 23 | Cauda paler than siphunculi | 24 |
| – | Cauda and siphunculi dark | 27 |
| 24 | On <i>Punica granatum</i> ; siphunculi rather pale; cauda with 7-9 hairs | <i>Aphis punicae</i> |
| – | Siphunculi dusky to dark; cauda with less than 7 hairs | 25 |
| 25 | On <i>Mentha</i> sp.; third antennal segment frequently bearing secondary rhinaria; unguis less than twice as long as basal part of last antennal segment | <i>Aphis affinis</i> |
| – | Polyphagous; third antennal segment without rhinaria; unguis more than twice as long as basal part of last antennal segment | 26 |
| 26 | Hairs on hind femur shorter than diameter of femur at its base | <i>Aphis gossypii</i> |
| – | Hairs on hind femur mainly longer than diameter of femur at its base | <i>Aphis nasturtii</i> |
| 27 | On <i>Citrus</i> sp.; dorsal side of abdomen without small dark sclerites | <i>Aphis spiraeicola</i> |
| – | Polyphagous; dorsal side of abdomen with small dark sclerites | <i>Aphis fabae</i> |
| 28 | Siphunculi as pale as body | <i>Schizaphis graminum</i> |
| – | Siphunculi darker than body | 29 |
| 29 | Siphunculi without flange (Fig. 4 c) | 30 |
| – | Siphunculi with flange (Fig. 4 e) | 32 |
| 30 | Cauda very pale, more than half as long as siphunculi | <i>Hysteroneura setariae</i> |
| – | Cauda dark, less than half as long as siphunculi | 31 |
| 31 | On <i>Cyperus rotundus</i> ; eighth abdominal tergite bearing three hairs | <i>Schizaphis rotundiventris</i> |
| – | On <i>Typha</i> sp.; eighth abdominal tergite bearing 3-6 hairs | <i>Paraschizaphis rosazevedoi</i> |
| 32 | Antennae with 5 segments, bearing very long hairs; abdominal tergite VIII with 4-8 hairs | <i>Rhopalosiphum rufiabdominalis</i> |
| – | Antennae with 6 segments, bearing short hairs; abdominal tergite VIII with 2 hairs | 33 |
| 33 | Body elongate; unguis 2.5 times as long as base of last antennal segment | <i>Rhopalosiphum maidis</i> |
| – | Body ovate; unguis three or more times as long as base of last antennal segment | <i>Rhopalosiphum padi</i> |
| 34 | Siphunculi with reticulation (Fig. 4 d) | 35 |
| – | Siphunculi without reticulation (Figs 4 f-h) | 44 |
| 35 | Antennal tubercles absent; front entirely flat; antennae without secondary rhinaria | <i>Pseudaphis</i> sp. |
| – | Antennal tubercles well developed; front not flat; antennae with secondary rhinaria | 36 |
| 36 | First tarsal joint with five hairs | 37 |
| – | First tarsal joint with three hairs | 39 |
| 37 | On <i>Sonchus</i> sp.; cauda pale, siphunculi pale at base | <i>Uroleucon sonchi</i> |

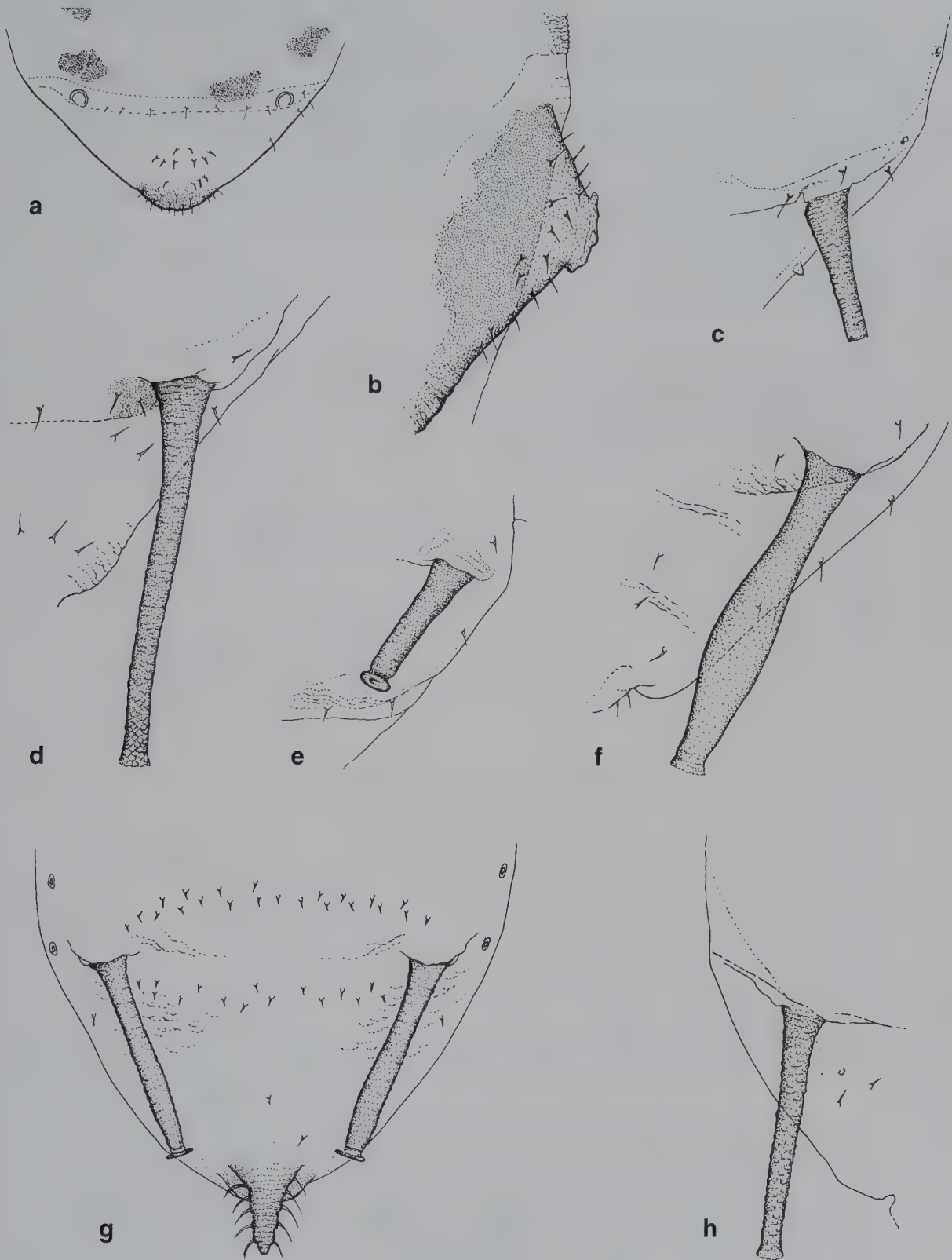


Fig. 4: Siphunculi of Arabian aphids: a, merely a pore, *Eriosoma lanigerum*; b, hairy cone, *Pterochloroides persicae*; c, tapering, *Aphis gossypii*; d, with subapical zone of polygonal reticulation, *Uroleucon sonchi*; e, swollen proximal to flange, *Rhopalosiphum padi*; f, swollen, *Hyperomyzus lactucae*; g, cylindrical and swollen slightly distally, *Myzus persicae*; h, cylindrical-like, *Acyrtosiphon kondoi*.

| | | |
|----|-----------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|
| – | Cauda dark, siphunculi uniformly dark | 38 |
| 38 | Lateral abdominal tubercles absent, cauda bearing 10-21 hairs | |
| | <i>Uroleucon compositae</i> | |
| – | Lateral abdominal tubercles present, cauda bearing 13-28 hairs | |
| 39 | Antennal tubercles small; hairs on third antennal segment inconspicuous; dorsal abdomen sclerotised | 40 |
| – | Antennal tubercles well developed; hairs on third antennal segment conspicuous; dorsal abdomen usually pale | 43 |
| 40 | Siphunculi pale to dusky | <i>Sitobion asirum</i> |
| – | Siphunculi dark to black | 41 |
| 41 | Abdomen with dorsal pigmentation consisting of segmentally arranged bars | |
| | <i>Sitobion africanum</i> | |
| – | Dorsal pigmentation often present but with ill-defined boundaries | 42 |
| 42 | Siphunculi less than twice as long as cauda | <i>Sitobion avenae</i> |
| – | Siphunculi about twice as long as cauda | <i>Sitobion fragariae</i> |
| 43 | Siphunculi pale at least at the base | <i>Macrosiphum euphorbiae</i> |
| – | Siphunculi black | <i>Macrosiphum rosae</i> |
| 44 | Antennal tubercles convergent in dorsal view (Fig. 3 b) | 45 |
| – | Antennal tubercles divergent (Figs 3 c, d) or parallel (Fig. 3 e) in dorsal view | 47 |
| 45 | Siphunculi swollen over distal half (Fig. 4 g) | <i>Myzus persicae</i> |
| – | Siphunculi not as above | 46 |
| 46 | Unguis less than three times as long as the base of last antennal segment; siphunculi with shallow S-curve | <i>Myzus ornatus</i> |
| – | Unguis more than four times longer than base of last antennal segment; siphunculi not as above | <i>Ovatus crataegarius</i> |
| 47 | Antennal tubercles parallel (Fig. 3 e) | 48 |
| – | Antennal tubercles divergent (Figs 3 c, d) | 49 |
| 48 | Third antennal segment bears more than four secondary rhinaria | |
| | <i>Rhodobium porosum</i> | |
| – | Third antennal segment bears 1-3 secondary rhinaria | <i>Aulacorthum solani</i> |
| 49 | Siphunculi slightly clavate to swollen | 50 |
| – | Siphunculi not as above | 52 |
| 50 | Third antennal segment of apterae with secondary rhinaria | <i>Hyperomyzus lactucae</i> |
| – | Third antennal segment of apterae without secondary rhinaria | 51 |
| 51 | Siphunculi shorter than cauda | <i>Hyadaphis coriandri</i> |
| – | Siphunculi longer than cauda | <i>Lipaphis erysimi</i> |
| 52 | Antennae less than two thirds of body length; siphunculi and cauda relatively short | |
| | <i>Lipaphis erysimi</i> | |
| – | Antennae more than two thirds of body length; siphunculi and cauda relatively long | 53 |
| 53 | Spiracular apertures round; third antennal segment of apterae with many rhinaria; antennal hairs long and conspicuous | <i>Nasonovia ribis-nigri</i> |
| – | Spiracles reniform; third antennal segment of apterae with or without only a few rhinaria; antennal hairs short and inconspicuous | 54 |
| 54 | Median frontal tubercles well developed (Fig. 3 d) | 55 |
| – | Median frontal tubercles undeveloped (Fig. 3 c) | 56 |
| 55 | On Poaceae; antennae progressively darker from base to apex; cauda with less than eight hairs | <i>Metopolophium festucae cerealium</i> |

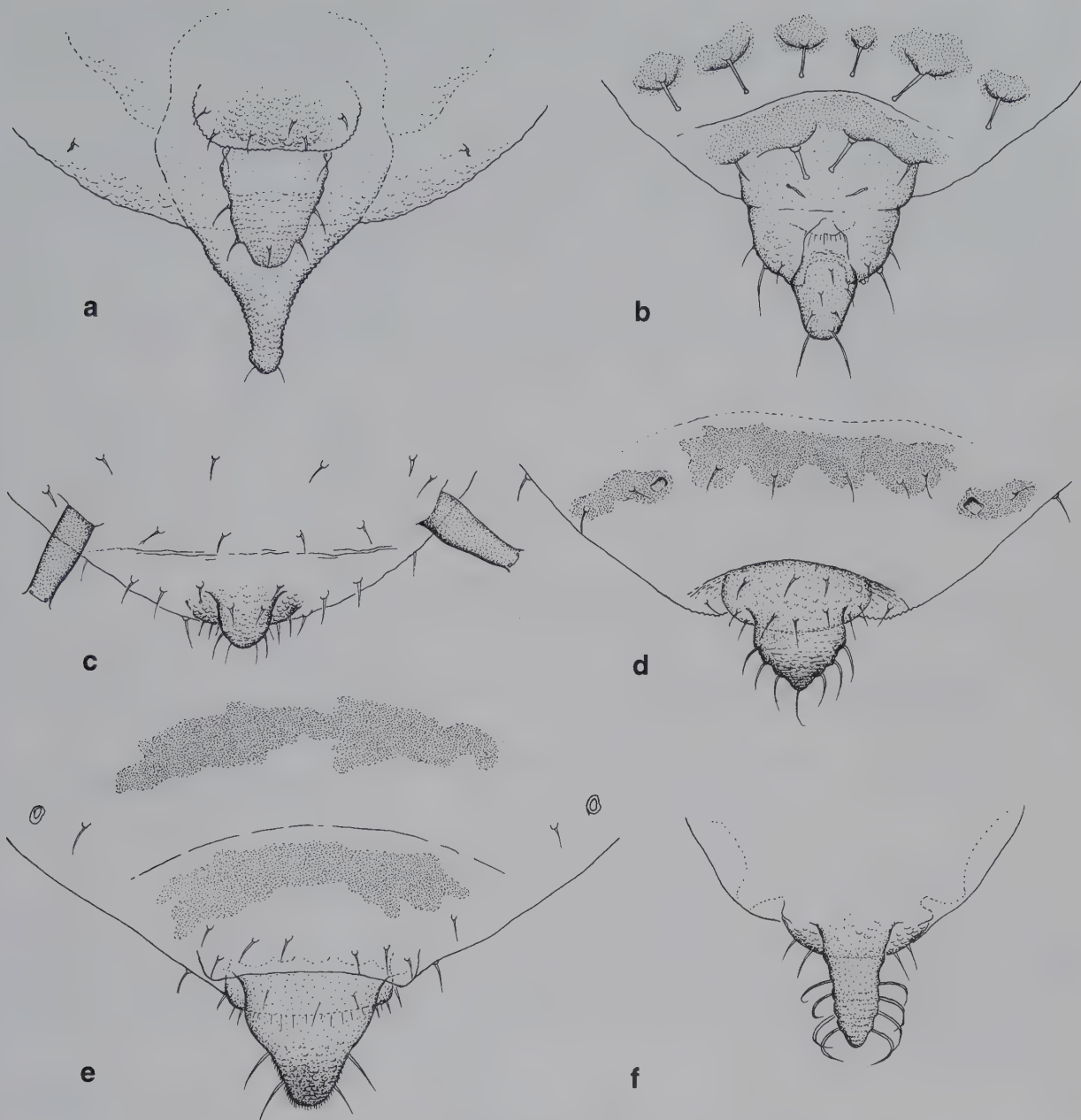


Fig. 5: Cauda of Arabian aphids: a, dorsal view of cauda supracaudal process, *Cavariella aegopodii*; b, knobbed with bilobed anal plate, *Therioaphis trifolii*; c, rounded, helmet-shaped, *Bruchycaudua helichrysi*; d, pentagonal, *Dysaphis emicis*; e, triangular, *Brevicoryne brassicae*; f, tongue-like, *Aphis gossypii*.

- On *Rosa* sp. or Poaceae; antennae not as above; cauda with more than eight hairs
Metopolophium dirhodum
- 56 On *Lactuca* sp.; ultimate rostral segment bears 16-25 accessory hairs (Fig. 2 b)
Acyrtosiphon lactucae
- On Fabaceae; ultimate rostral segment bears less than ten accessory hairs 57
- 57 Siphunculi 2.5-3.5 times as long as cauda
Acyrtosiphon gossypii
- Siphunculi less than 2.5 times as long as cauda 58

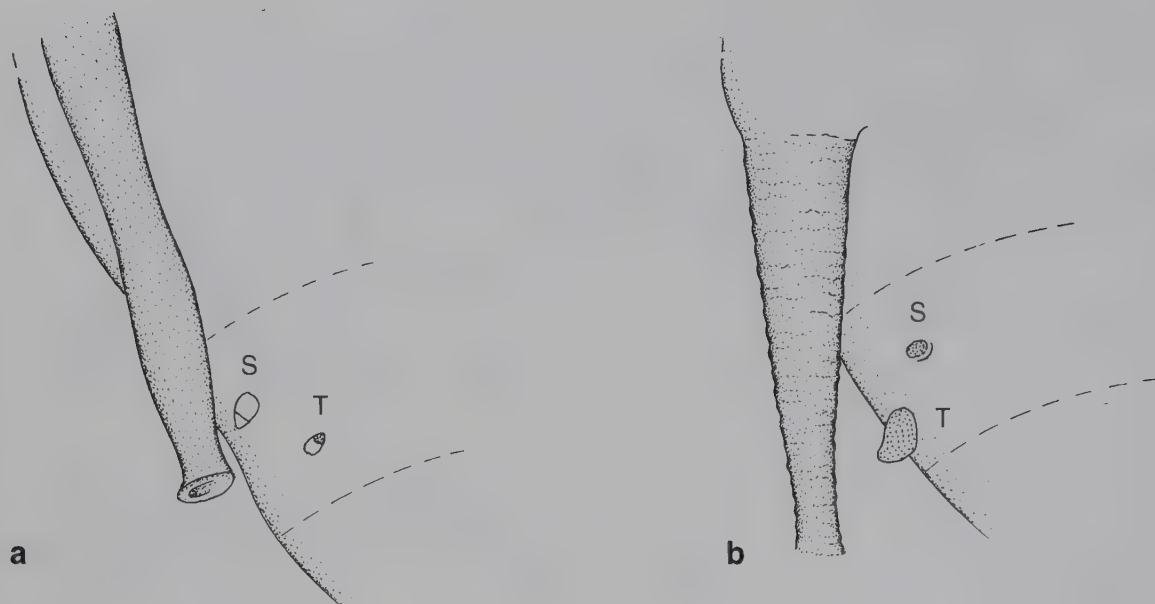


Fig. 6. Arrangement of spiracle (S) and abdominal tubercle (T): a, *Rhopalosiphum* sp.; b, *Aphis* sp.

- 58 On *Medicago sativa*; articulation between antennal segment III and IV with black pigment *Acyrtosiphon kondoi*
 — On Fabaceae; articulation between antennal segment III and IV without black pigment *Acyrtosiphon pisum*

SPECIES DESCRIPTIONS

Sixty-one aphid species and subspecies were recorded in this study, representing four subfamilies. The descriptions of subfamilies, tribes, genera and species included here are restricted to the aphids which were collected by the authors. Genera descriptions will not be included if only one species from a genus is reported.

Subfamily Aphidinae

This subfamily is the largest one recorded in this study. The members of the Aphidinae show the following characters: Antennae long, unguis usually longer than basal part of last antennal segment; cauda tongue-shaped or triangular, but never knobbed; siphunculi tube-like, with or without reticulation. Fifty-six species were recorded in this subfamily within two tribes (Aphidini and Macrosiphini).

Tribe Aphidini

Antennal tubercles undeveloped (Fig. 3 a); unguis longer and rarely shorter than basal part of last antennal segment; spiracles of abdominal segments I and II placed far apart; lateral abdominal

tubercles usually present on segments I and VII; siphunculi are usually longer than cauda, but not reticulated. Twenty-four species and subspecies within eight genera were recorded from this tribe.

Genus *Aphis* Linnaeus, 1758

Small to medium-sized aphids; antennal tubercles undeveloped; antennae with 5-6 segments and shorter than body, unguis longer than basal part of last antennal segment; wing venation normal, fore wing with media two-branched; cauda tongue-shaped, siphunculi tapering and longer than cauda except in *A. hillerislambersi*; abdomen with marginal tubercles on segments I and VI. Ants were observed attending with most species. *Aphis* is the largest genus in terms of the numbers of species collected in this study. Twelve species and subspecies were recorded from this genus.

Aphis affinis del Guercio, 1911

Aphis affinis del Guercio, 1911. — Redia 7: 296-233.

Aphis affinis. — van Harten et al. 1994: 39 (Sana'a).

Material: Riyadh: 26.V.1990 from *Mentha longifolia*, 8.I.1990, 27.V.1990 and 29.V.1990 from *Mentha piperata*; Al-Dawadmy: 28.I.1990 from *M. piperata*; Al-Uyaynah: 11.I.1990 from *M. piperata*; Abha: 2.IV.1992 from *M. piperata*; Jizan: 13.III.1995 from *M. piperata*.

Description: Body black; the unguis less than twice as long as the basal part of the last antennal segment; cauda pale and siphunculi dusky to dark.

Specimens were collected from the stem of the host plants. *A. affinis* is a new record for the fauna of Saudi Arabia. It occurs in South and Central Europe, North Africa, the Middle East, West and Central Asia (ILHARCO 1988).

Aphis (Protophis) armoraciae Cowen, 1895

Aphis armoraciae Cowen, 1895. — Bull. Agr. Exp. Sta. Col. Tech. (1): 115-125.

Material: Riyadh: 2 apterous morphs from roots of *Helianthus annuus*, 15.III.1993.

Description: Colour yellowish-green; unguis a little longer than the basal part of the last antennal segment; secondary rhinaria present on antennal segments III and IV of apterous morph. Siphunculi and cauda short and dusky; dorsum with well-developed secrotic pattern.

This is the first record of *A. armoraciae* from the Arabian Peninsula. The species is native to North America, but has been found in Brazil, Australia and South Africa (MILLAR 1990).

Aphis craccivora Koch, 1854

Aphis craccivora Koch, 1854. — Pflanzenl. Aphiden 1: 1-134.

Aphis leguminosae Theobald, 1915. — Bull. Ent. Res. 6: 121 (Egypt: Ghezireh and Gizeh).

Aphis craccivora. — Habib & El-Kady 1961: 107-109, Fig. 55.

Aphis craccivora. — Martin 1972: 18.

Aphis craccivora. — Al-Ali 1977: 37 (Iraq: countrywide).

Aphis craccivora. — Müller et al. 1977: 248, Fig. 12 (Sudan).

Aphis craccivora. — Mustafa 1985: 162 (Jordan: countrywide).

Aphis craccivora. — van Harten et al. 1994: 40 (Highlands of Yemen).

Material: Riyadh: 13.XII.1989 from *Capsicum frutescens*, 22.XII.1991 from *Cestrum nocturnum*, 26.III.1990 from *Chlorophytum sternbergianum*, 26.III.1990 from *Citrus* sp., 16.XII.1989 from *Clitoria* sp., 6.XII.1989 from *Cucurbita pepo*, 9.IV.1990 from *Cucurbita* sp., 16.XII.1989 from *Dolichos lablab*, 21.X.1990 from *Ficus* sp., 26.III.1990 from *Gazania splendens*, 26.III.1990 from *Jasminum sambac*, 9.XII.1989, 5.I.1990, 31.III.1990 and 5.IV.1991 from *Lawsonia inermis*, 6.XII.1989, 26.XII.1989, 8.I.1990, 20.I.1990 and 9.VII.1990 from *Medicago sativa*, 26.III.1990 and 5.IV.1990 from *Melilotus indica*, 9.IV.1990 from *Neurada procumbens*, 23.VIII.1990 from *Pithecellobium dulce*, 23.I.1990 from *Prosopis juliflora*, 9.IV.1990 from *Prunus armeniaca*, 6.XII.1989 from *Raphanus sativus*, 13.XII.1989 from *Schinus molle*, 19.XII.1989, 10.I.1990, 15.III.1990, 23.III.1990 and 21.IX.1990 from *Tecoma stans*, 30.XII.1989 from *Vicia faba*, 16.XII.1989 from *Vigna unguiculata*; Al-Dawadmy:

28.I.1990 from *Brassica rapa*, 28.I.1990 from *M. sativa*; Al-Uyaynah: 21.I.1990 from *M. sativa*, 9.II.1990 from *V. faba*; Huraymala: 11.I.1990 from *M. sativa*; Al-Aflaj: 1.III.1992 from *M. sativa*; Al-Kharj: 28.I.1990 from *Phaseolus vulgaris*; Tabuk: 5.I.1992 from *Ocimum basilicum*, 26.VII.1991 from *M. sativa*, 12.VI.1992 and 25.VI.1992 from *Portulaca oleracea*; Abha: 21.VIII.1992 from *Chenopodium ambrosioides*, 22.II.1992 from *M. sativa*; Jizan: 9.III.1995 from flower heads of *Aloe vera*.

Description: Body length 1.4-2.1 mm, colour shiny dark brown to black; dorsum usually entirely sclerotic and pigmented; legs pale yellow to green; cauda and siphunculi dark.

Fifty-one samples were collected during the study. Specimens were most abundant during February. Twenty-nine different host plants were recorded for this species though found most frequently on Fabaceae.

Aphis fabae fabae Scopol, 1763

Aphis fabae Scopol, 1763. — Ent. Carn.: 136-140.

Aphis fabae. — Martin 1972: 18.

Aphis fabae. — Al-Ali 1977: 37 (Mosul, Baghdad and Diwaniya).

Aphis fabae. — Mustafa 1985: 162 (Jordan: countrywide).

Material: Riyadh: 23.XII.1989 from *Cestrum nocturnum*, 6.XII.1989 from *Cucurbita pepo*, 29.II.1990 from *Dianthus caryophyllus*, 8.I.1990 from *Dodonea viscosa*, 13.I.1990 from *Nerium oleander*, 8.I.1990 from *Pelargonium* sp., 8.I.1990 and 15.III.1990 from *Tecoma stans*, 25.I.1990 from *Trigonella foenum-graecum*; Al-Uyaynah: 21.I.1990 from *Beta vulgaris*, 11.II.1993 from *Chlorophytum sternbergianum*, 10.II.1993 from *Vicia faba*; Al-Kharj: 28.I.1990 from *Citrus* sp.; Abha: 26.X.1994 from *Verbesinia encelioides*; Khamis Mushayt: 6.V.1992 from *Physallis longifolia*; Suda, Asir: 26.X.1994 from *Rumex obtusifolius*; Jizan: 12.III.1995 from *V. faba*.

Description: Body length 1.5-2.2 mm, colour blackish-brown to black; antennae pale but segments I, II and unguis dark; legs pale; cauda dark with 8-20 hairs; abdominal tergite VIII with four hairs.

Aphis fabae solanella Theobald, 1914

Aphis solanella Theobald, 1914. — Bull. Ent. Res. 4: 313-337.

Aphis solanella. — Al-Ali 1977: 38 (Iraq: countrywide).

Aphis solanella. — Müller et al. 1977: 248, Fig. 20.

Aphis solanella. — Mustafa 1988 b: 46 (Amman and Mafraq).

Aphis solanella. — van Harten et al. 1994: 41 (Sana'a).

Material: Riyadh: 19.I.1990, 20.II.1990 and 4.V.1990 from *Solanum nigrum*; Khamis Mushayt: 10.VIII.1992 from *S. nigrum*.

Description: Colour dark brown; antennae pale; legs pale; siphunculi brown and relatively long; cauda black and short.

This is the first record for this subspecies, *A. f. solanella*, from Saudi Arabia. It occurs in Europe, Asia, North, East, and South Africa and South America (Heie 1986).

Aphis gossypii Glover, 1877

Aphis gossypii Glover, 1877. — Rep. Comm. Agr. Oper. Dep. Wash.: 36.

Aphis gossypii. — Habib & El-Kady 1961: 104-105, Fig. 52.

Aphis gossypii. — Martin 1972: 18.

Aphis gossypii. — Al-Ali 1977: 37 (Middle and South of Iraq).

Aphis gossypii. — Müller et al. 1977: 248, Fig. 19.

Aphis gossypii. — Mustafa 1985: 163 (Jordan: widespread).

Aphis gossypii. — van Harten et al. 1994: 40 (Sana'a).

Material: Riyadh: 15.III.1990 from flower heads of *Aloe vera*, 11.XI.1991 from *Brassica oleracea*, 26.III.1990 from *Calendula officinalis*, 15.III.1990 from *Capsicum frutescens*, 12.IV.1990 from *Catharanthus roseus*, 13.XII.1989 from *Chenopodium ambrosioides*, 26.XII.1989 from *Chrysanthemum leucanthemum*, 14.XII.1989, 31.XII.1989 and 20.V.1991 from *Citrullus colocynthis*, 12.IV.1990 and 11.II.1992 from *Citrus* sp., 13.XII.1989 from *Convolvulus arvensis*, 21.X.1990, 20.V.1991, 22.V.1991 and 29.XI.1992 from *Cucumis* sp., 9.XII.1989, 20.VI.1990, 22.VI.1990, 25.VI.1990, 3.X.1990, 25.X.1990, 19.V.1991, 2.VI.1991, 25.V.1991, 2.VI.1991, 10.XI.1991, 25.XI.1991 and 25.V.1992 from *Cucurbita pepo*, 6.IV.1993 from

Cucurbita sp., 4.IX.1991 from *Dolichos lablab*, 20.VI.1990 from *Ficus carica*, 25.X.1990 from *Gossypium* sp., 25.I.1990 from *Helianthus annuus*, 26.III.1990, 15.VII.1990, 1.X.1990, 20.V.1991 and 27.V.1991 from *Hibiscus esculentus*, 15.III.1990 from *Hibiscus rosa-sinensis*, 9.XII.1989 from *Malva parviflora*, 26.V.1989 from *Mentha piperata*, 26.III.1990 from *Myoporum laetum*, 5.I.1990 from *Ocimum basilicum*, 26.III.1990 from *Pittosporum tobira*, 22.V.1992 from *Prunus armeniaca*, 22.V.1992 from *Punica granatum*, 3.II.1990 from *Salvia splendens*, 4.IX.1991 from *Solanum melongena*, 3.II.1992 from *Solanum tuberosum*, 9.XII.1989, 5.II.1992 from *Tecoma stans*, 20.VI.1990 from *Vitis vinifera*; Al-Kharj: 13.I.1990 from *Cucumis* sp., 13.I.1990 from *C. pepo*; Al-Uyaynah: 21.I.1990 from *Citrus* sp., 26.XII.1989 from *C. pepo*; Al-Dawadmy: 19.I.1990 from *C. pepo*; Abha: 7.IV.1994 from *Ficus* sp., 12.VIII.1992 from *Phragmanthera regularis*, 25.X.1994 from *Withania somnifera*; Jizan: 9.III.1995 from flower heads of *A. vera*, 10.III.1990 and 10.III.1995 from *H. esculentus*, 10.III.1995 from *Mangifera indica*, 9.I.1995 from *Tribulus pentandrus*; Tabuk: 4.VIII.1991 from *D. lablab*, 4.VIII.1991 from *S. melongena*.

Description: Body length 0.8-1.8 mm, body length was longest at low temperatures (in winter) and shortest at high temperatures (ALDRYHIM & KHALIL 1993). Very variable in colour, black, blackish-green, green, yellowish-green and pale yellow; siphunculi dusky to dark with pale cauda.

The species was found throughout the year but was most numerous in March and April.

Aphis hillerislambersi Nieto & Mier, 1976

Aphis hillerislambersi Nieto & Mier, 1976. — Rev. Esp. Ent. (Eos) 51: 69-79.

Material: Abha: 24.II.1990 from *Euphorbia granulata*, 26.X.1994 from *Euphorbia schimperiana*.

Description: Antennae less than 0.6 of body length; unguis 1.1-1.3 times as long as basal part of last antennal segment; cauda more than 1.5-2.0 times as long as siphunculi.

The species is a new record for the fauna of the Arabian Peninsula. This aphid occurs in Spain, France, Corsica, Italy, Canary and Blearis Island and Portugal. The species description and distribution are discussed by NIETO & MIER (1976) and NIETO (1985).

Aphis nasturtii Kaltenbach, 1843

Aphis nasturtii Kaltenbach, 1843. — Mono. Fam. Pflanzenl.: 223.

Aphis nasturtii. — Mustafa 1986: 211 (Jerash).

Aphis nasturtii. — van Harten et al. 1994: 40 (Highlands of Yemen).

Material: Riyadh: 9.XII.1989 from *Lawsonia inermis*; Khamis Mushayt: 23.V.1992 from *Physallis longifolia*; Abha: 9.II.1990 from *Rumex nervosus*.

Description: Apterous adults bright yellow-green; siphunculi and cauda dusky. Some hairs on hind femur were longer than the diameter of the femur.

Aphis nerii Boyer de Fonscolombe, 1841

Aphis nerii Boyer de Fonscolombe, 1841. — Ann. Soc. Ent. Fr. 10: 179-180.

Aphis nerii. — Habib & El-Kady 1961: 101-103, Fig. 50.

Aphis nerii. — Martin 1972: 18.

Aphis nerii. — Al-Ali 1977: 38 (Baghdad).

Aphis nerii. — Müller et al. 1977: 248, Fig. 18.

Aphis nerii. — Mustafa 1985: 163 (Jordan Valley).

Aphis nerii. — van Harten et al. 1994: 41 (Sana'a and Kaukaban).

Material: Riyadh: 24.XII.1989, 28.XII.1989 and 20.IX.1991 from *Calotropis procera*, 31.XII.1989 from *Pergularia tomentosa*; Al-Kharj: 21.XI.1989, 28.XII.1989 and 28.I.1990 from *C. procera*; Al-Uyaynah: 9.XII.1989 from *C. procera*; Najran: 22.V.1992 from *C. procera*; Qatif: 2.XI.1991 from *Nerium oleander*; Abha: 7.4.1994 from *N. oleander*; Jizan: 8.I.1995 from *C. procera*.

Description: Body length 1.4-2.3 mm, yellow in colour, with dark appendages; first segment of hind tarsus with three hairs; abdominal tergite VIII with two hairs.

Aphis punicae Passerini, 1863

Aphis punicae Passerini, 1863. — Arch. Zool. Anat. Fisiol. 2: 129-212.

Aphis punicella Theobald, 1915. — Bull. Ent. Res. 6: 125 (Egypt: Ghezireh).

Aphis durantae Theobald, 1918. — Bull. Ent. Res. 8: 274 (Egypt: Ghezireh).

Aphis punicae. — Habib & Al-Kady 1961: 109-110, Fig. 56.

Aphis punicae. — Martin 1972: 18.

Aphis punicae. — Al-Ali 1977: 38 (Mosul, Baghdad and Kerbale).

Aphis punicae. — Mustafa 1985: 163 (Jordan: widespread).

Aphis punicae. — van Harten et al. 1994: 41 (Sana'a).

Material: Riyadh: 31.XII.1989, 8.I.1990, 9.IV.1990, 20.V.1990, 23.V.1990, 25.V.1990, 2.VI.1990, 20.VI.1990 and 21.X.1990 from *Punica granatum*; Khamis Mushayt: 4.VI.1990 from *P. granatum*; Tabuk: 26.VIII.1991 from *P. granatum*; Nigran: 22.V.1992 from *P. granatum*.

Description: Small aphids, yellow green to dark green in colour; antennae dark and short; siphunculi rather pale, cauda yellowish-green. They were collected mainly from the upper surface of leaves of pomegranate, *P. granatum*.

Aphis spiraecola Patch, 1914

Aphis spiraecola Patch, 1914. — Maine Agr. Expt. Sta. Bull. 233: 270.

Aphis spiraecola. — Mustafa 1989: 350 (Jubeiha).

Aphis spiraecola. — van Harten et al. 1994: 42 (Tawilah and Sana'a).

Material: Riyadh: 5.IX.1992 from *Citrus* sp.; Al-Uyaynah: 21.I.1990 from *Citrus* sp.

Description: Body length 1.2-2.1 mm, thorax and abdomen light green with dark brown head; antennae pale; legs pale; cauda and siphunculi black, abdominal tergite VIII with two hairs.

Aphis ?urticata Gmelin, 1790

Aphis urticata Gmelin, 1790. — Lipsiae 1 (4): 2204.

Material: Riyadh: 1 alate viviparous female from unknown host, W. Büttiker.

Description: Body length 1.3 mm, usually yellowish-green with pale appendages; the antennal segment of the alate morph with six faint secondary rhinaria.

This is the first record of *A. urticata* from Saudi Arabia. The species occurs in Europe, Central Asia and the Mediterranean region (ILHARCO 1973).

Genus *Brachyunguis* Das, 1918

Aphids small; antennae about half as long as the body, antennal tubercles not developed, unguis shorter than the base of last antennal segment. Two species were recorded from this genus.

Brachyunguis harmalae Das, 1918

Brachyunguis harmalae Das, 1918. — Mem. Ind. Mus. 6: 135-274.

Brachyunguis harmalae. — Al-Ali 1977: 39 (Mosul and Baghdad).

Brachyunguis harmalae. — van Harten et al. 1994: 43 (Highlands of Yemen).

Material: Riyadh: 27.IX.1990 from *Calotropis procera*, 12.IV.1990 from *Prosopis juliflora*; Jizan: 7.I.1995 from *C. procera*.

Description: Body length 0.7-1.6 mm, pale green; pale appendages; cauda longer than siphunculi which are 0.3-0.4 times as long as antennal segment III.

Brachyunguis tamaricis (Lichtenstein, 1885)

Aphis tamaricis Lichtenstein, 1885. — Bull. Soc. Ent. Fr. 5: 179-180.

Aphis tamaricis. — Theobald 1918; Bull. Ent. Res. 8: 278-279 (Egypt: Gizeh).

Brachyunguis tamaricis. — Habib & El-Kady 1961: 97-98, Fig. 48.

Brachyunguis ?tamaricis. — Martin 1972: 18.

Brachyunguis tamaricis. — Al-Ali 1977: 39 (Baghdad, Diwaniya and Basra).

Brachyunguis tamaricis. — van Harten et al. 1994: 45 (Sana'a).

Material: Riyadh: 9.IV.1990 from *Tamarix* sp.; Abha: 7.IV.1994 from *Tamarix* sp.; Jizan: 13.III.1995 from *Tamarix* sp.

Description: Body length 0.8-1.7 mm, body and appendages are rather dark green compared to *B. harmalae*; cauda shorter than siphunculi which are 0.8-0.9 times as long as antennal segment III.

Genus *Hyalopterus* Koch, 1854

These aphids have a medium-sized, elongated body; antennae with six segments and shorter in length than body, antennal tubercles undeveloped; siphunculi shorter and thinner than cauda which is constricted at its base with a rounded apex. Two species were recorded from this genus.

Hyalopterus amygdali (Blanchard, 1840)

Aphis amygdali Blanchard, 1840. — after Eastop & Hille Ris Lambers 1976: 219.

Hyalopterus amygdali. — Al-Ali 1977: 14 (Baghdad and Hilla).

Material: Tabuk: 4.IX.1991 from *Prunus persica*.

Description: Colour light green; siphunculi short and broad, about twice as long as their maximum diameter.

This is a new record for the fauna of the Arabian Peninsula. The species occurs in Europe, the Mediterranean region, the Middle East and Central Asia to Pakistan (BLACKMAN & EASTOP 1984).

Hyalopterus pruni (Geoffroy, 1762)

Aphis pruni Geoffroy, 1762. — after Heie 1986: 41.

Hyalopterus pruni. — Habib & El-Kady 1961: 117-119, Fig. 63.

Hyalopterus pruni. — Al-Ali 1977: 41 (Iraq: countrywide).

Hyalopterus pruni. — Müller et al. 1977: 246, Fig. 7.

Hyalopterus pruni. — Mustafa 1986: 212 (Sweileh).

Material: Riyadh: 19.XII.1989 and 24.XII.1994 from *Arundo donax*; Tabuk: 30.VI.1990 from *Prunus armeniaca*, 4.IX.1991 from *Prunus persica*.

Description: Aphids yellowish-green having bodies covered with wax; siphunculi short and slender, siphunculi 3-4 times longer than their maximum diameter; cauda tongue-shaped and dark.

This is a new record for Saudi Arabia. The species has been found world-wide (BLACKMAN & EASTOP 1984).

Genus *Hysteroneura* Davis, 1919

Hysteroneura setariae (Thomas, 1878)

Siphonophora setariae Thomas, 1878. — Ill. St. Lab. Nat. Hist. Bull. 2: 3-16.

Hysteroneura setariae. — van Harten et al. 1994: 49 (Yemen: widespread).

Material: Riyadh: 26.XII.1989, 9.IV.1990 and 12.IV.1990 from *Cynodon dactylon*, 26.I.1992 from *Dodonea viscosa*, 6.I.1990 from *Eragrostis* sp., 13.I.1990 from seedlings of *Phoenix dactylifera*; Tabuk: 26.I.1992 from *Phalaris minor*, Abha: 25.X.1994 from *Arundo donax*, 7.IV.1994 from *Pennisetum typhoides*; Jizan: 29.XII.1994 from *Panicum turgidum*; Farasan Island: 29.XII.1994 from *Dactyloctenium aegyptium*, 29.XII.1994 from *P. turgidum*.

Description: Colour red-brown to black; antennal tubercles undeveloped, antennae with six segments, unguis longer than basal part of last antennal segment, antennal segments VI, V and distal apex of segment IV dark; pale legs and cauda which is constricted; siphunculi dark, tapering and longer than cauda.

Genus *Melanaphis* van der Goot, 1917*Melanaphis sacchari* (Zehntner, 1897)

Aphis sacchari Zehntner, 1897. — Arch. Suiker. Ned-Ind. 5: 551.

Aphis sorghi Theobald, 1904. — Theobald 1914; Bull. Ent. Res. 4: 321 (Sudan).

Longinunguis sacchari. — Martin 1972: 18.

Longinunguis sacchari. — Al-Ali 1977: 42 (Baghdad).

Longinunguis sacchari. — Müller et al. 1977: 248, Fig. 17.

Melanaphis sacchari. — van Harten et al. 1994: 51 (Yemen: widespread).

Material: Riyadh: 8.I.1990 from *Sorghum sudanense*, 16.XII.1989 and 6.I.1990 from *Sorghum vulgare*, 11.II.1991 from *Zea mays*, Al-Kharj: 31.XII.1989 and 28.I.1990 from *S. vulgare*, Huraymala: 11.I.1990 from *Hordeum vulgare*, Abha: 25.X.1994 from *Arundo donax*, 25.X.1994 from *S. vulgare*, Jizan: 29.II.1994 from *S. vulgare*.

Description: Body length 1.2–2.2 mm, body elongated, colour variable from yellowish-green to black with pale appendages; antennal tubercles undeveloped; antennae with six segments, but in a few specimens, which were collected from *S. vulgare* in Jizan, with five segments; siphunculi shorter than cauda which is constricted.

Genus *Rhopalosiphum* Koch, 1854

The aphids of this genus have antennal tubercles undeveloped, antennae with five or six segments and shorter than body, unguis longer than the basal part of last antennal segment; media of fore wing with two forks; siphunculi are flanged and longer than cauda which is tongue-shaped. Three species were recorded from this genus.

Rhopalosiphum maidis (Fitch, 1856)

Aphis maidis Fitch, 1856. — Trans. N.Y. Agric. Soc. 15: 178–330.

Rhopalosiphum maidis. — Habib & El-Kady 1961: 122–123, Fig. 65.

Rhopalosiphum maidis. — Martin 1972: 18.

Rhopalosiphum maidis. — Al-Ali 1977: 43 (Iraq: widespread).

Rhopalosiphum maidis. — Mustafa 1985: 165 (Blawnah, Jubeiha, Jordan Valley).

Rhopalosiphum maidis. — van Harten et al. 1994: 49 (Southern Yemen).

Material: Riyadh: 16.XII.1989 and 31.XII.1989 from *Hordeum vulgare*, 10.I.1990 from *Pennisetum typhoides*, 16.XII.1989 from *Setaria viridis*, 22.V.1991 from *Sorghum sudanense*, 20.XII.1989 from *Triticum aestivum*, Al-Kharj: 28.I.1990 from *Aristida adscensionis*, 28.I.1990 from *Chloris virgata*, 28.I.1990 from *Eragrostis* sp., 28.I.1990 from *Latipes senegalensis*, 26.XII.1989 from *Sorghum vulgare*, 28.I.1990 from *Zea mays*, Al-Uyaynah: 21.I.1990 from *Saccharum officinarum*, 18.XII.1989 from *S. vulgare*, 21.I.1990 from *T. aestivum*, Huraymala: 11.I.1990 from *T. aestivum*, Al-Aflaj: 1.III.1992 from *H. vulgare*, 1.III.1992 from *Z. mays*, Taif: 19.I.1991 from *H. vulgare*, Khamis Mushayt: 22.V.1991 from *S. vulgare*, Dammam: 21.IX.1991 from *Z. mays*, Jizan: 29.XI.1994 from *Echinochola colona*, 29.XI.1994 from *Panicum coloratum*, Farasan Island: 27.XII.1994 from *S. vulgare*.

Description: Body small and elongated, bluish-green to olive-green in colour; short antennae and siphunculi; dark siphunculi, cauda and legs.

Rhopalosiphum padi (Linnaeus, 1758)

Aphis padi Linnaeus, 1758. — Syst Nat. 10: 451.

Rhopalosiphum padi. — Habib & El-Kady 1961: 125–126, Fig. 65.

Rhopalosiphum padi. — Mustafa 1986: 213.

Rhopalosiphum padi. — van Harten et al. 1994: 57 (Sana'a).

Material: Riyadh: 16.XII.1989, 3.I.1990 and 20.III.1990 from *Triticum aestivum*, 26.XII.1989 from *Zea mays*, Al-Aflaj: 1.III.1992 from *T. aestivum*, 1.III.1992 from *Hordeum vulgare*, Jizan: 12.III.1995 from *Z. mays*.

Description: Body small and ovate, pale-green to black in colour; legs dark green; siphunculi dark.

Rhopalosiphum rufiabdominalis (Sasaki, 1899)

Toxoptera rufiabdominalis Sasaki, 1899. — Rep. Hok. Agric. Exp. Sta. 17: 202.

Rhopalosiphum rufiabdominalis. — Al-Ali 1977: 43 (Baghdad).

Rhopalosiphum rufiabdominalis. — van Harten et al. 1994: 57 (Sana'a).

Material: Riyadh: 17.I.1995 from roots of *Coriandrum sativum*, 26.IV.1995 from roots of *Phalaris minor*.

Description: Aphids green in colour; antennae with five segments bearing very long hairs; abdominal tergite VIII with 4-8 hairs. Specimens were collected from the roots of the host plants.

Genus *Schizaphis* Börner, 1931

These aphids have antennal tubercles undeveloped; media of the fore wing with only one branch; siphunculi pale, tapering without a flange, dorsal spinules absent. Three species were recorded from this genus.

Schizaphis graminum (Rondani, 1852)

Aphis graminum Rondani, 1852. — Nuovi. Ann. Soc. Nat. Bologna 6: 10.

Schizaphis graminum. — Martin 1972: 18.

Schizaphis graminum. — Al-Ali 1977: 44 (Diyala, Baghdad and Hilla).

Schizaphis graminum. — Müller et al. 1977: 246, Fig. 10.

Schizaphis graminum. — van Harten et al. 1994: 57 (Sana'a).

Material: Riyadh: 26.III.1990 from *Avena sativa*, 14.III.1990 from *Triticum aestivum*; Al-Kharj: 28.I.1990 from *Zea mays*; Hail: 20.III.1990 from *Hordeum vulgare*; Abha: 3.VI.1991 from *T. aestivum*; Jizan: 11.III.1995 from *A. sativa*.

Description: Body length 1.3-1.9 mm, body yellowish-green to dark green in colour; antennae shorter than body; siphunculi pale with dark apices.

Schizaphis rotundiventris (Signoret, 1860)

Schizoneura rotundiventris Signoret, 1860. — Ann. Soc. ent. Fr. 8 (3): 178.

Aphis acori Theobald, 1922. — Bull. Soc. Ent. Egypte 7: 50-52 (Egypt: Ghezireh).

Acaudus calami Theobald, 1922. — Bull. Soc. Ent. Egypte 7: 60-61 (Egypt: Ghezireh).

Hysteroneura (*Schizaphis*) *cyperi* (van der Goot, 1917). — Habib & El-Kady 1961: 130-131, Fig. 70.

Material: Riyadh: 7.I.1990 and 18.V.1995 from *Cyperus rotundus*.

Description: Colour dark green; antennae a little shorter than the body.

This is a new record for the fauna of Saudi Arabia. The species has been found in Southern Europe, India, Pakistan, Japan, Philippines, Malaysia, Indonesia, Australia and New Zealand (BLACKMAN & EASTOP 1984).

Subgenus *Paraschizaphis* Hill Ris Lambers, 1947*Paraschizaphis rosazevedoi* Ilharco, 1961

Paraschizaphis rosazevedoi Ilharco, 1961. — Agros. Lisb. 49: 71-77.

Material: Riyadh: 11.I.1990 and 24.XII.1994 from *Typha* sp.

Description: Body length 1.6-1.9 mm, colour golden-brown to red; dark antennae; legs light brown to yellow; siphunculi dark, eighth abdominal tergite bearing 3-6 hairs. For more details of the species description see ILHARCO (1961).

This is the first record of *Paraschizaphis rosazevedoi* from the Arabian Peninsula. It occurs in Europe.

Tribe Macrosiphini

Antennal tubercles usually well developed; unguis longer than basal part of last antennal segment; spiracles of abdominal segments I and II close to each other; siphunculi longer than cauda, siphunculi with or without reticulation; lateral abdominal tubercles usually absent on segments I and VII. Thirty-two species were recorded from this tribe.

Genus *Acyrtosiphon* Mordvilko, 1914

Medium-sized to large aphids; antennal tubercles well developed and diverging, antennae as long as body or longer, unguis at least twice as long as base of last antennal segment; siphunculi are long, tapering or cylindrical not reticulated; the cauda is tongue-shaped, long and tapering. Four species were recorded from this genus.

Acyrtosiphon gossypii Mordvilko, 1914

Acyrtosiphon gossypii Mordvilko, 1914. — Faune de la Russi 1: 1-236.

Acyrtosiphon gossypii. — Al-Ali 1977: 41 (Baghdad and Ramadi).

Acyrtosiphon gossypii. — van Harten et al. 1994: 37 (Yemen: widespread).

Material: Riyadh: 4.II.1990 from *Vicia faba*; Abha: 12.VIII.1992 from *Dolichos lablab*.

Description: Colour pale green to dark green; siphunculi very long and slender. The specimens were found individually (not in colonies) on the leaves of their hosts.

Acyrtosiphon kondoi Shinji, 1938

Acyrtosiphon kondoi Shinji, 1938. — after Eastop & Hille Ris Lambers 1976: 14.

Acyrtosiphon kondoi. — van Harten et al. 1994: 38 (Sana'a, Rayda, Beit Nihm).

Material: Riyadh: 25.XII.1989, 8.I.1990, 8.X.1990 from *Medicago sativa*; Al-Kharj: 28.I.1990 from *M. sativa*; Al-Dawadmy: 23.I.1990 from *M. sativa*; Hail: 2.I.1990, 20.III.1990, 25.III.1990 and 8.X.1990 from *M. sativa*.

Description: Specimens bluish-green to dark-green; forming colonies on stems and leaves of alfalfa, *Medicago sativa*.

This species is a new record for the fauna of Saudi Arabia. It probably originated in the far east of Asia and has been introduced to North and South America, Australia and South Africa (BLACKMAN & EASTOP 1984).

Acyrtosiphon (Tija) lactucae (Passerini, 1860)

Siphonophora lactucae Passerini, 1860. — after Eastop & Hille Ris Lambers 1976: 14.

Acyrtosiphon (Tija) scariolae (Nevsky, 1929). — Al-Ali 1977: 37 (Iraq: countrywide).

Acyrtosiphon lactucae. — Mustafa 1988 a: 78 (Jordan: widespread).

Acyrtosiphon lactucae. — van Harten et al. 1994: 39 (Sana'a).

Material: Al-Uyaynah: 24.II.1990 from *Lactuca sativa*; Taif: 25.I.1990 from *L. sativa*.

Description: Specimens pale yellowish-green to pale-green; siphunculi long, slender and tapering.

Acyrtosiphon pisum (Harris, 1776)

Aphis pisum Harris, 1776. — Exposit. English Insect, London: 66-67.

Acyrtosiphon pisum. — Habib & El-Kady 1961: 76-78, Fig. 38.

Acyrtosiphon pisum. — Mustafa 1985: 162 (Wadi Shueib).

Acyrtosiphon pisum. — van Harten et al. 1994: 37 (Sana'a, Rayda and Beit Nihm).

Material: Riyadh: 4.II.1990 from *Vicia faba*.

Description: Specimens with light green body and a light brown thorax. They were found forming large colonies on the leaves and stems of their hosts.

Genus *Aulacorthum* Mordvilko, 1914

Aulacorthum solani (Kaltenbach, 1843)

Aphis solani Kaltenbach, 1843. — Mono. Fam. Pflanzenl.: 15.

Aulacorthum solani. — van Harten et al. 1994: 42 (Sumara and Sayani).

Material: Abha: 5.IV.1990 from an unidentified host.

Description: Specimens green in colour; antennal tubercles parallel and spinulose, antennal segment III of the apterous morph bears fewer than four secondary rhinaria.

This is the first record of *A. solani* from Saudi Arabia. It is polyphagous and occurs world-wide (VAN HARTEN et al. 1994).

Genus *Brachycaudus* van der Goot, 1913

Small aphids with antennal tubercles small or absent, antennae usually with six segments, shorter than the body; cauda very short and broad or semi-circular; spiracular apertures rounded. Two species were recorded for this genus.

Brachycaudus helichrysi (Kaltenbach, 1843)

Aphis helichrysi Kaltenbach, 1843. — Mono. Fam. Pflanzenl.: 102.

Brachycaudus helichrysi. — Habib & El-Kady 1961: 82-84, Fig. 41.

Anuraphis (Brachycaudus) helichrysi. — Martin 1972: 18.

Brachycaudus helichrysi. — Al-Ali 1977: 39 (Baghdad).

Brachycaudus helichrysi. — van Harten et al. 1994: 43 (Yemen: widespread).

Material: Riyadh: 15.III.1993 from *Helianthus annuus*; Abha: 26.X.1994 from *Euryops arabicus*, 7.IV.1994 from *Prunus persica*.

Description: Body length 0.9-2.0 mm, light yellowish-green; antennal tubercles slightly developed; cauda about as long as broad and shorter than the siphunculi; siphunculi tapering and longer than their own basal width.

Brachycaudus rumexicolens (Patch, 1917)

Aphis (Thuleaphis) rumexicolens Patch, 1917. — after Eastop & Hille Ris Lambers 1976: 112.

Brachycaudus (Thuleaphis) rumexicolens. — van Harten et al. 1994: 43 (Sana'a and Al-Mahwit).

Material: Suda, Asir: 7.IV.1994 from *Rumex obtusifolius*.

Description: Body length 1.5-1.9 mm, brownish-yellow in life; cauda very short with its basal width exceeding its length; siphunculi length as long as the basal width.

This is the first record for the species *B. rumexicolens* from Saudi Arabia. The species occurs in Europe, Central Asia, Africa and North America (ILHARCO 1974).

Genus *Brevicoryne* van der Goot, 1915

Brevicoryne brassicae (Linnaeus, 1758)

Aphis brassicae Linnaeus, 1758. — Syst. Nat. 10: 452.

Brevicoryne brassicae. — Habib & El-Kady 1961: 84-86, Fig. 42.

Brevicoryne brassicae. — Martin 1972: 18.

Brevicoryne brassicae. — Al-Ali 1977: 39 (Iraq: widespread).

Brevicoryne brassicae. — Müller et al. 1977: 246, Fig. 7.

Brevicoryne brassicae. — Mustafa 1985: 164 (Jordan: widespread).

Brevicoryne brassicae. — van Harten et al. 1994: 44 (Taiz, Mukeiras).

Material: Riyadh: 26.III.1990 from *Antirrhinum majus*; 26.V.1991 and 2.VI.1991 from *Brassica oleracea*, 21.I.1990 from *Brassica rapa*; Al-Kharj: 21.XI.1989 and 26.XI.1989 from *B. oleracea*; Al-Uyaynah: 21.I.1990 from *B. oleracea*; Jizan: 15.III.1995 from *B. rapa*.

Description: Body length 1.5-2.2 mm, body covered with greyish-white wax; siphunculi short and swollen, cauda short and triangular.

Genus *Cavariella* del Guercio, 1911

Cavariella aegopodii (Scopoli, 1763)

Aphis aegopodii Scopoli, 1763. — Ent. Carn.: 399.

Cavariella aegopodii. — Theobald 1922; Bull. Soc. Ent. Egypte 7: 44-45 (Egypt: Gizeh).

Cavariella aegopodii. — Mustafa 1986: 212 (Ghore El-Safi and Ethrah).

Cavariella aegopodii. — van Harten et al. 1994: 47 (Sana'a).

Material: Riyadh: 23.I.1990, 24.I.1990, 29.III.1990 and 22.III.1992 from *Petroselinum crispum*; Abha: 12.XII.1992 from *Anethum graveolens*, 5.IV.1992 from *Anisum sativum*.

Description: Body length 1.3-2.2 mm, pale green to dark green; body with a supracaudal process on the eighth abdominal tergite, siphunculi longer than cauda and swollen distally.

Genus *Dysaphis* Börner, 1931

Small to medium-sized aphids, body covered with a grey-white wax; antennal tubercles slightly developed, antennae shorter than the body length; siphunculi short and cauda helmet-shaped. Three species were recorded from this genus.

Dysaphis apiifolia (Theobald, 1922)

Anuraphis apiifolia Theobald, 1922. — Bull. Soc. Ent. Egypte 7: 39-80.

Sappaphis (*Dysaphis*) *apiifolia*. — Al-Ali 1977: 44 (Ramadi).

Material: Riyadh: 23.I.1990 and 24.I.1990 from *Petroselinum crispum*.

Description: Body length 1.2-2.2 mm, body light-brown, covered with grey-white wax; antennae and legs pale in colour; siphunculi dark.

Specimens were collected from leaf bases and stems of the host plant below the soil surface.

This is the first record of *D. apiifolia* from Saudi Arabia. It is found in Europe, the Middle East, Central Asia, North Africa, South Africa, Australia, North and South America (MILLAR 1990).

Dysaphis emicis (Mimeur, 1935)

Anuraphis emicis Mimeur, 1935. — Bull. Soc. Sci. Nat. Moroc. 14: 178-190.

Material: 13.VIII.1992, 7.IV.1994, 26.X.1994 and 16.III.1995 from *Rumex obtusifolius*.

Description: Body of apterae covered with white wax; antennal and body hairs long; siphunculi dark and short.

Specimens were collected from stem bases of the host plant below the soil surface.

This is the first record of *D. emicis* from the Arabian Peninsula. It occurs in Morocco, Spain and Portugal (ILHARCO 1973).

Dysaphis foeniculus (Theobald, 1922)

Anuraphis foeniculus Theobald, 1922. — Bull. Soc. Ent. Egypte 7: 39-80.

Sappaphis foeniculus. — Al-Ali 1977: 44 (Baghdad).

Dysaphis foeniculus. — Mustafa 1988 b: 47 (Wadi Husban).

Material: Riyadh: 4.II.1990 from *Daucus carota*; Al-Kharj: 28.I.1990 from *D. carota*; Abha: 26.X.1994 from *Foeniculus vulgare*.

Description: Body length 1.7-2.1 mm, body covered with greyish-white wax; pale appendages.

This is the first record of *D. foeniculus* from Saudi Arabia. This species occurs in the Mediterranean, East and South Africa, Australia, New Zealand and North and South America (MILLAR 1990).

Genus *Hyadaphis* Kirkaldy, 1904

Hyadaphis coriandri (Das, 1918)

Brevicoryne coriandri Das, 1918. — Mem. Indian. Mus. 6: 135-274.

Hyadaphis coriandri. — van Harten et al. 1994: 49 (Sana'a and Rissabah).

Material: Riyadh: 26.IV.1995 from *Petroselinum crispum*.

Description: Body length 1.2-1.8 mm, dark green; antennal tubercles slightly developed, antennae shorter than the body, third antennal segment of apterae without secondary rhinaria; siphunculi black, clavate and shorter than cauda which is tongue-shaped.

Genus *Hyperomyzus* Börner, 1933

Hyperomyzus lactucae (Linnaeus, 1758)

Aphis lactucae Linnaeus, 1758. — Syst. Nat. 10: 452.

Nasonovia (*Hyperomyzus*) *lactucae* (Linnaeus, 1758). — Habib & El-Kady 1961: 88-90, Fig. 44.

Hyperomyzus lactucae. — Mustafa 1985: 164 (Jerash, Baq'a and Rmameen).

Hyperomyzus lactucae. — van Harten et al. 1994: 49 (Sada).

Material: Riyadh: 12.IV.1992 from *Sonchus oleraceus*; Qasim: 15.II.1992 from *S. oleraceus*.

Description: Body length 2.0-2.7 mm; rhinaria are numerous on the basal half of the third antennal segment of apterae; siphunculi swollen and twice as long as the cauda which is tongue-shaped.

Genus *Lipaphis* Mordvilko, 1928

Lipaphis erysimi (Kaltenbach, 1843)

Aphis erysimi Kaltenbach, 1843. — Mono Fam. Pflanzenl: 99.

Lipaphis erysimi pseudobrassicae (Davis, 1914). — Habib & El-Kady 1961: 86-88, Fig. 43.

Rhopalosiphum erysimipseudobrassicae. — Martin 1972: 18.

Lipaphis erysimi pseudobrassicae (Davis, 1914). — Müller et al. 1977: 248, Fig. 16.

Lipaphis erysimi. — Al-Ali 1977: 41-42 (Iraq: countrywide).

Lipaphis erysimi. — Mustafa 1985: 164 (Jordan: widespread).

Lipaphis erysimi. — van Harten et al. 1994: 50 (Sana'a and Al-Kowd).

Material: Riyadh: 21.I.1990 from *Brassica rapa*, 28.XII.1989 from *Raphanus sativus*; Al-Uyaynah: 13.XII.1989 from *Brassica oleracea*; Huraymala: 11.I.1990 from *R. sativus*; Al-Dawadmy: 28.I.1990 from *R. sativus*.

Description: Body length 1.4-2.1 mm, yellowish-green in colour, having bodies slightly covered with wax; antennal tubercles weakly developed, third antennal segment of apterae without secondary rhinaria; siphunculi short and slightly swollen.

Genus *Macrosiphum* Passerini, 1860

Medium-sized to large aphids with antennal tubercles well developed; the first segment of the tarsus has three setae; siphunculi reticulated, cauda tongue-shaped and about half as long as siphunculi. Two species were recorded from this genus.

Macrosiphum euphorbiae (Thomas, 1878)

Siphonophora euphorbiae Thomas, 1878. — State. Lab. Nat. Hist. Bull. 2: 6.

Macrosiphum euphorbiae. — Al-Ali 1977: 42 (Mosul).

Macrosiphum euphorbiae. — Mustafa 1985: 164 (Baq'a and Jerash).

Macrosiphum euphorbiae. — van Harten et al. 1994: 50-51 (Sana'a and Sanhan).

Material: Riyadh: 25.I.1990 from *Canna indica*, 20.III.1990 from *Catharanthus roseus*, 22.III.1990 from *Citrus* sp., 15.I.1990 from *Ipomoea* sp., 25.II.1990 from *Lactuca sativa*, 9.III.1990 from *Morus alba*, 31.I.1990 from *Pisum sativum*, 26.III.1990 from *Pittosporum tobira*, 9.IV.1990 from *Prunus armeniaca*, 26.II.1990 from *Rosa* sp.; Abha: 7.IV.1994 from *Alkanna orientalis*, 7.IV.1994 from *Chenopodium murale*, 7.IV.1994 from *Convolvulus arvensis*, 12.VIII.1992 from *Dolichos lablab*, 30.III.1992 from *Helianthus annuus*, 7.IV.1994 from *Lactuca saligna*, 7.II.1990 from *Lycium arabicum*, 10.VIII.1990 from *Lycopersicon esculentum*, 7.IV.1994 from *Malus silvestris*, 26.X.1994 from *Verbesinia encelioides*, Jizan: 13.III.1995 from *Rosa* sp.

Description: Body length 2.1-3.1 mm, green with pale appendages; cauda tapering and bearing 4-5 pairs of hairs.

Macrosiphum rosae (Linnaeus, 1758)

Aphis rosae Linnaeus, 1758. — Syst. Nat. 10: 452.

Macrosiphum rosae. — Habib & El-Kady 1961: 50-52, Fig. 24.

Macrosiphum rosae. — Al-Ali 1977: 42 (Mosul, Erbil, Baghdad and Basra).

Macrosiphum rosae. — Mustafa 1985: 164 (Jordan: widespread).

Macrosiphum rosae. — van Harten et al. 1994: 51 (Sana'a).

Material: Taif: 30.I.1990 from *Rosa* sp.; Abha: 5.IV.1992 from *Rosa* sp.

Description: Body length 3.1 mm (from one specimen), colour green; siphunculi, legs and head dark, cauda pale.

Genus *Metopolophium* Mordvilko, 1914

Medium-sized to large aphids with antennal tubercles moderately developed, median frontal tubercle well developed; siphunculi imbricated and long, but not reticulated. Two species were recorded from this genus.

Metopolophium dirhodum (Walker, 1848)

Aphis dirhoda Walker, 1849. — Ann. Mag. Nat. Hist. 3: 43-53.

Metopolophium dirhodum. — Mustafa 1988 a: 80 (Deir-Allah and Blawnah).

Material: Abha: 30.III.1990 from *Avena futua*, 30.III.1990 from *Avena sativa*, 30.III.1990 from *Triticum aestivum*.

Description: Body length 1.9-2.7 mm, pale green with pale appendages except for the distal antennal segments which are dark.

Metopolophium festucae cerealium Stroyan, 1982

Metopolophium festucae cerealium Stroyan, 1982. — Zoo. J. Lin. Soc. 75: 91-141.

Metopolophium festucae. — Mustafa 1988 b: 48 (Rumtha).

Material: Riyadh: 21.III.1990 from *Triticum aestivum*; Hail: 20.III.1990 from *Hordeum vulgare*.

Description: Specimens yellowish-green to yellow; pale siphunculi and cauda.

This species is a new record for the fauna of Saudi Arabia. The subspecies, *M. f. cerealium*, occurs only in Europe. The species *M. festucae* occurs in Europe, Iceland (BLACKMAN & EASTOP 1984) and in Jordan (MUSTAFA 1988 b).

Genus *Myzus* Passerini, 1860

Small aphids with antennal tubercles well developed and convergent; siphunculi flanged and longer than the cauda which is tongue-shaped. Two species were recorded from this genus.

Myzus ornatus Laing, 1932

Myzus ornatus Laing, 1932. — Ent. Mon. Mag. 68: 52.

Myzus ornatus. — Mustafa 1986: 213 (Rmameen and Baq'a).

Myzus ornatus. — van Harten et al. 1994: 51 (Sana'a and Djebel An-Nabi Shuaib).

Material: Abha: 7.II.1990 from *Ocimum basilicum*.

Description: Specimens yellowish-green to pale green with pale appendages; unguis less than 2.5 times as long as the base of last antennal segment; siphunculi shape a shallow S-curve.

Myzus persicae (Sulzer, 1776)

Aphis persicae Sulzer, 1776. — Abgek. Gesch. Ins. 11: 105.

Myzus persicae. — Theobald 1922; Bull. Soc. Ent. Egypte 7: 42 (Egypt: Cairo and Gizeh).

Myzus persicae. — Al-Ali 1977: 42 (Iraq: countrywide).

Myzus persicae. — Müller et al. 1977: 146, Fig. 11.

Myzus persicae. — Mustafa 1985: 165 (Jordan: countrywide).

Myzus persicae. — van Harten et al. 1994: 53 (Sana'a, Suda and Mukeiras).

Material: Riyadh: 19.XII.1989 from *Althaea rosea*, 6.I.1990 from *Beta vulgaris* var. *cicla*, 23.III.1990 from *Bougainvillea spectabilis*, 9.II.1993 from *Brassica napus*, 4.II.1990 and 20.II.1990 from *Capsicum frutescens*, 18.XI.1991 from *Cestrum nocturnum*, 8.I.1990 from *Citrus* sp., 24.XII.1989 and 21.III.1990 from *Clerodendron inerme*, 20.I.1990 from *Convolvulus arvensis*, 24.XII.1989 and 31.XII.1989 from *Convolvulus* sp., 26.XII.1989 from *Eruca sativa*, 9.XII.1989 from *Helianthus annuus*, 21.XII.1989 from *Hibiscus rosa-sinensis*, 26.XII.1989 from *Ipomoea* sp., 4.II.1990 from *Lycopersicum esculentum*, 31.XII.1989 from *Malva parviflora*, 23.III.1990 from *Malvaviscus arboreus*, 26.III.1990 *Petunia hybrida*, 26.III.1990 from *Pisum sativum*, 28.XII.1989 from *Raphanus sativus*, 23.I.1990 from *Rosa* sp., 30.XII.1989 and 3.II.1990 from *Solanum melongena*, 16.XII.1989 from *Solanum tuberosum*, 16.XII.1989 and 31.XII.1989 from *Spinacia oleracea*, 23.I.1990 from *Tagetes patula*, 31.XII.1989 from *Urtica urens*; Al-Kharj: 28.I.1990 from *Heliotropium bacciferum*, 28.I.1990 from *Plantago lanceolata*, 21.IX.1989 from *S. melongena*; Huraymla: 11.I.1990 from *B. rapa*; Al-Dawadmy: 20.I.1990 and 28.I.1990 from *E. sativa*, 20.I.1990 and 20.I.1990 from *Brassica oleracea*, 28.I.1990 from *Brassica rapa*, 20.I.1990 from *Lactuca sativa*, 20.I.1990 from *Petroselinum crispum*, 28.I.1990 from *R. sativus*; Abha: 12.VIII.1992 from *C. frutescens*, 26.X.1994 from *Euryops arabicus*, 23.VI.1992 and 12.VIII.1992 from *Prunus persica*; Jizan: 13.III.1995 from *R. sativus*.

Description: Body length 1.4-2.1 mm, pale yellow, yellowish-green or dark green with pale appendages; unguis more than 2.5 times longer than base of last antennal segment; siphunculi swollen on distal half. *M. persicae* is polyphagous and can be found on many different plant families.

Genus *Nasonovia* Mordvilko, 1914*Nasonovia ribis-nigri* (Mosley, 1841)

Aphis ribisnigri Mosley, 1841. — Gard. Chronicle 1: 684.

Material: Abha: 7.IV.1994 from *Lactuca sativa*.

Description: Specimens pale yellow to brownish-green; antennae with six segments, antennal tubercles moderately developed, median frontal tubercle well developed; siphunculi cylindrical, apex of siphunculi with a characteristic annular constriction before the distinct flange.

N. ribis-nigri is a new record for the fauna of Saudi Arabia. It is native to Europe and has been introduced to both North and South America (BLACKMAN & EASTOP 1984).

Genus *Ovatus* van der Goot, 1913*Ovatus crataegarius* (Walker, 1850)

Aphis crataegarius Walker, 1850. — Ann. Mag. Nat. Hist. 6 (2): 46.

Ovatus crataegarius. — Mustafa 1985: 165 (Amman and Jerash).

Ovatus crataegarius. — van Harten et al. 1994: 53 (Sana'a).

Material: Abha: 7.II.1990 from *Malus silvestris*, 7.II.1990 from *Ocimum basilicum*.

Description: Body length 1.5-1.9 mm; antennal tubercles well developed and convergent, pale green in colour; siphunculi tapering and pale.

Genus *Pseudaphis* Hille Ris Lambers 1954*Pseudaphis* sp.

Material: Abha: 25.X.1994 from *Pennisetum setaceum*, 7.IV.1994 from *Pennisetum typhoides*.

Description: Brown in colour; antennal tubercles absent, the front is entirely flat, antennae with six segments, shorter than body, apterae without secondary rhinaria; siphunculi are just as long as the cauda, with 1-4 rows of polygonal reticulation at the apex. No alate morphs were collected.

Genus *Rhodobium* Hille Ris Lambers, 1947 1976: 376*Rhodobium porosum* (Sanderson, 1900)

Myzus porosus Sanderson, 1901. — Rep. Del. Agric. Exp. St. 12: 142-211.

Macrosiphum rosaefolium Theobald, 1915. — Bull. Ent. Res. 6: 109.

Rhodobium porosum. — Habib & El-Kady 1961: 65-66, Fig. 32.

Rhodobium porosum. — van Harten et al. 1994: 55 (Sana'a).

Material: Riyadh: 6.I.1991 from *Rosa* sp.; Abha: 5.IV.1992 from *Rosa* sp.

Description: Body length 1.5-2.3 mm, yellowish-green in colour; antennal tubercles parallel, antennal segment III bearing more than four secondary rhinaria.

Genus *Sitobion* Mordvilko, 1914

Aphids medium-sized with a dark sclerotic dorsum; antennal tubercles not highly developed; cauda pale with black, reticulated siphunculi. Four species were recorded from this genus.

Sitobion africanum (Hille Ris Lambers, 1954)

Macrosiphum (Sitobion) africanum Hille Ris Lambers, 1954. — Boll. Lab. Zoo. Gen. Agr. Portici 23: 169-185.

Sitobion africanum. — van Harten et al. 1994: 59 (Al Tawilah).

Material: Abha: 7.IV.1994 from *Ficus* sp., 7.IV.1994 from *Pennisetum setaceum*.

Description: Light brown to dark brown in colour; abdomen with dorsal pigmentation consisting of segmentally arranged bars.

Sitobion asirum Aldryhim & Ilharco 1996

Sitobion asirum Aldryhim & Ilharco 1996. — Fauna of Saudi Arabia 15: 157-160.

Material: Abha: 23.V.1992, 12.VIII.1992, 7.IV.1994, 26.X.1994, 14.III.1995 from *Phragmanthera regularis*.

Description: Body length 1.68-1.98 mm, light green; siphunculi pale. Aphids forming small colonies on the upper leaf surface of the host plants. *S. asirum* was described as a new species by ALDRYHIM & ILHARCO (1996).

***Sitobion avenae* (Fabricius, 1775)**

Aphis avenae Fabricius, 1775. — Syst. Ent.: 736.

Sitobion avenae. — Habib & El-Kady 1961: 52-53, Fig. 25.

Macrosiphum (Sitobion) avenae. — Al-Ali 1977: 42 (Baghdad and Hilla).

Sitobion avenae. — Mustafa 1985: 165 (Irbid, Naimah, Huson and Ramtha).

Material: Riyadh: 8.II.1992 from *Setaria verticillata*, 7.IV.1992 and 9.IV.1992 from *Triticum aestivum*.

Description: Colour light green; siphunculi less than twice as long as cauda.

***Sitobion fragariae* (Walker, 1848)**

Aphis fragariae Walker, 1848. — Ann. Mag. Nat. Hist. 1: 443-345.

Sitobion fragariae. — Mustafa 1988 a: 81 (Deir-Allah, Ghore).

Material: Riyadh: 7.IV.1992, 9.IV.1992 from *Triticum aestivum*; Al-Aflaj: 1.III.1992 from *Avena sativa*.

Description: *S. fragariae* is yellowish-green to dark green; siphunculi black and about twice as long as cauda.

This species is a new record for the fauna of Saudi Arabia. It occurs in Europe, the Mediterranean, the Middle East, South Africa, Australia, New Zealand, Antipodes and western North America (BLACKMAN & EASTOP 1984).

Genus *Uroleucon* Mordvilko, 1914 (= *Dactynotus* Rafinesque, 1818)

Medium-sized to large aphids with antennal tubercles well developed and diverging; first segment of the tarsus with five setae; siphunculi reticulated. Three species were recorded from this genus.

***Uroleucon compositae* (Theobald, 1915)**

Macrosiphum compositae Theobald, 1915. — Bull. Ent. Res. 6: 103-153.

Uroleucon compositae. — Müller et al. 1977: 246, Fig. 3.

Uroleucon compositae. — Eastop 1985: 400 (Saudi Arabia).

Uroleucon compositae. — Mustafa 1988 a: 81 (Ghore El-Safi and Amman).

Uroleucon compositae. — van Harten et al. 1994: 61 (Sana'a and Djebel An-Nabi Shuaib).

Material: Riyadh: 14.X.1993 from *Calendula officinalis*, 2.III.1992 from *Centaurea moschata*.

Description: Body length 2.5-3.5 mm, dark brown to black; siphunculi dark.

***Uroleucon jaceae* (Linnaeus, 1758)**

Aphis jaceae Linnaeus, 1758. — Syst. Nat. 10: 452.

Dactynotus (Uromelan) jaceae. — Habib & El-Kady 1961: 47-48, Fig. 22.

Dactynotus jaceae. — Al-Ali 1977: 40 (Erbil).

Material: Qasim: 6.IV.1993 from *Carthamus tinctorius*.

Description: Specimens light brown in colour with black antennae and siphunculi, cauda dark.

The species is a new record for the fauna of Saudi Arabia. It occurs in Europe, the Middle East and Central Asia (BLACKMAN & EASTOP 1984).

***Uroleucon sonchi* (Linnaeus, 1767)**

Aphis sonchi Linnaeus, 1767. — Syst. Nat. 10: 452.

Dactynotus sonchi (Linnaeus). — Habib & El-Kady 1961: 45-46, Fig. 21.

Macrosiphum (Dactynotus) sonchi (Linnaeus). — Martin 1972: 18.

Dactynotus sonchi (Geoffroy, 1762). — Al-Ali 1977: 40 (Mosul, Baghdad, Kut and Kerbala).

Uroleucon sonchi. — Mustafa 1985: 165 (Jordan: widespread).

Material: Riyadh: 19.XII.1989, 26.XII.1989, 7.IV.1990, 9.IV.1990, 12.IV.1992 and 21.V.1992 from *Sonchus oleraceus*; Al-Aflaj: 1.III.1992, 2.III.1992, 1.II.1993 from *S. oleraceus*; Abha: 12.VIII.1992 from *S. oleraceus*, 14.III.1995 from *S. oleraceus*.

Description: Body length 2.5-3.1 mm, dark bronze to dark brown; legs pale yellow except for joints; siphunculi dark but pale or dusky at middle, cauda pale.

Subfamily Drepanosiphinae

The subfamily Drepanosiphinae can be recognised from the following characters: knobbed cauda; bilobed anal plate; short truncated siphunculi. Two species were recorded from this subfamily.

Genus *Saltusaphis* Theobald, 1915

Saltusaphis scirpus Theobald, 1915

Saltusaphis scirpus Theobald, 1915. — Bull. Ent. Res. 6: 103-153.

Saltusaphis scirpus. — Müller et al. 1977: 248, Fig. 22.

Saltusaphis scirpus. — van Harten et al. 1994: 35 b (Sana'a, Al-Kowd and Wadi Bana).

Material: Riyadh: 7.I.1990 and 12.V.1990 from *Cyperus rotundus*.

Description: Body narrow, yellowish-green to dull-green in colour, covered with spines; head elongate with large eyes, antennae with six segments; cauda knobbed, siphunculi reduced to merely rings.

Genus *Therioaphis* Walker, 1870

Therioaphis trifolii f. *maculata* (Buckton, 1899)

Chaitophorus maculatus Buckton, 1899. — Ind. Mus. Notes 4: 277-276.

Therioaphis trifolii (Monell, 1882). — Habib & El-Kady 1961: 14.

Therioaphis trifolii (Monell, 1882). — Martin 1972: 18.

Therioaphis trifolii (Monell, 1882). — Al-Ali 1977: 44 (Baghdad).

Therioaphis trifolii maculata. — Müller et al. 1977: 248, Fig. 23.

Therioaphis maculata. — Mustafa 1985: 165 (Jordan Valley).

Therioaphis trifolii (Monell, 1882). — van Harten et al. 1994: 35 (Sana'a, Mukeiras).

Material: Riyadh: 8.I.1990 and 10.I.1990 from *Medicago sativa*; Al-Kharj: 28.I.1990 from *M. sativa*; Abha: 12.VIII.1992 from *M. sativa*; Hail: 13.VIII.1992 from *M. sativa*.

Description: These aphids are small, yellowish-cream to yellowish-green, body armed dorsally with spines; antennae with six segments; the cauda is knobbed, siphunculi truncate. Secondary sensoria are present on the third antennal segment of the apterous morph.

Subfamily Lachninae

The members of this subfamily can be recognised from the following characteristics: pear-shaped siphunculi placed on hairy cones, rounded cauda; antennae with six segments with short unguis; body with long fine setae. Two species were recorded from this subfamily.

Genus *Cinara* Curtis, 1835

Cinara maghrebica Mimeur, 1934

Cinara maghrebica Mimeur, 1934. — Mem. Soc. Sc. Nat. Maroc. 40: 2-5.

Material: Abha: 12.VIII.1992 and 13.VIII.1992 from *Pinus halepensis*.

Description: Specimens are medium-sized to large, body colour brown; head and thorax dark; siphunculi on hairy cones, cauda rounded.

This species is a new record for the fauna of Saudi Arabia. It is native to Morocco and has been introduced to southern Europe and Argentina (ILHARCO 1973).

Genus *Pterochloroides* Mordvilko, 1914

Pterochloroides persicae (Cholodkovsky, 1899)

Lachnus persicae Cholodkovsky, 1899. — Zool. Anz. 22: 468-477.

Dryaphis persicae (Cholodkovsky, 1899). — Theobald 1914, Bull. Ent. Res. 4: 334, Fig. 16 (upper Egypt).

Pterochloroides persicae. — Habib & El-Kady 1961: 33-34, Fig. 16.

Pterochloroides persicae. — Mustafa 1985: 165 (Jordan: widespread).

Pterochloroides persicae. — van Harten et al. 1994: 63 (Sana'a).

Material: Abha: 23.V.1992 and 12.VIII.1992 from *Prunus domestica*, 23.V.1992 and 12.VIII.1992 from *Prunus persica*, 23.V.1992 and 12.VIII.1992 from *Prunus spinosa*.

Description: These are large aphids (3.5-4.5 mm), brown in colour, bearing yellow hairs on the dorsal side of the abdomen; legs yellow to pale brown; siphunculi on hairy cones, cauda broadly rounded. They were found in large patches on proximal parts of host branches in May, whereas in August (the rainy season) they were found in small patches on distal parts of branches near the main trunk, probably seeking shelter from rain. Alatae were very rare. Honeydew was excreted profusely and ants were attending these aphids.

This species is a new record for the fauna of Saudi Arabia. It occurs in Asia and its range was recently found to extend into Europe (BLACKMAN & EASTOP 1984).

Subfamily Pemphiginae

This subfamily may be distinguished by the siphunculi which are merely pores (pore-shaped) and rounded cauda; short antennae, unguis very short; wax glands forming groups on the body. One species was recorded from this subfamily.

Genus *Eriosoma* Leach, 1818

Eriosoma lanigerum (Hausmann, 1802)

Aphis lanigera Hausmann, 1802. — Illig. Mag. 1: 426-445.

Eriosoma lanigera. — Habib & El-Kady 1961: 189, Fig. 8.

Eriosoma lanigerum. — Al-Ali 1977: 40 (Iraq: countrywide).

Eriosoma lanigerum. — Mustafa 1985: 164 (Amman, Tubeiha, Sarih and Salt).

Eriosoma lanigerum. — van Harten et al. 1994: 33 (Sana'a and Mabar).

Material: Riyadh: 19.XII.1989 from *Malus silvestris*.

Description: Specimens with a small body covered with a thick white wax; antennae with five segments, shorter than the body, antennal tubercles undeveloped; siphunculi merely rings, cauda rounded.

HOST PLANTS

The aphids' host plants are presented in the Appendix. A total of 138 plant species representing 47 plant families were found to be infested by aphids. Species of Poaceae (Gramineae), Fabaceae, Asteraceae (Compositae) and Solanaceae were the most common host plants.

The number of aphid species per host plant species varied. Specifically 56.9, 23.1, 9, 7, 2, 0.7, and 0.7 % of the total plant species were infested by one, two, three, four, five, six, and seven aphid species, respectively. The wheat plant, *Triticum aestivum*, was infested by seven aphid species.

ACKNOWLEDGEMENTS

We are most grateful to F.A. Ilharco, Estação Agronómica Nacional (Oeiras, Portugal) for assisting with identification of the aphids and for reviewing the manuscript. We thank G. Remaudière, Muséum National d'Histoire Naturelle (Paris, France), S. Barbagaloo, Università degli Studi di Catania (Catania, Italy), M.B. Stoetzel, U.S. Department of Agriculture (Maryland, U.S.A), and T. Thief, University of Rostock (Rostock, Germany) for assisting with the identification of the aphids. We thank O.E. Heie, The Royal Danish School of Educational Studies (Copenhagen, Denmark), H.J. Harlian (Maryland, USA), T. Elhag, King Saud University (Riyadh, Kingdom of Saudi Arabia), V.F. Eastop and Blackman, The Natural History Museum (London, U.K.) for their critical revision of the manuscript and the valuable comments. Special thanks to H.L.G. Stroyan for providing us with literature and to A.H. Alfarhan and J. Tomas, College of Sciences, for assisting with the identification of plants and reviewing the plant list. We also offer our thanks to F. Saadawy, M. Hammad, M. Eid and S. Khalil, College of Agriculture, for assisting with the identification of plants. We thank A. Alsarar and F. Alatwi for assisting with aphid sampling. We thank P. Vantieghem-Symens for making the drawings. Thanks also to Gazan Agricultural Development Co. (GAZADCO) for providing housing and transportation during the visits of the first author to Jizan.

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Appendix

List of host plants for Saudi Arabian Aphididae. The list contains only hosts from which the authors have seen aphids. It is in alphabetical order of families and species within families. Aphids from the same plant host are in alphabetical order. As the hosts for *Aphis urticata* and *Aulacorthum solani* were not known they have not been included in this list.

| Host plants | Aphid species |
|-----------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|
| Family Anacardiaceae | |
| <i>Mangifera indica</i> | <i>Aphis gossypii</i> |
| <i>Schinus molle</i> | <i>Aphis craccivora</i> |
| Family Apiaceae (Umbelliferae) | |
| <i>Anethum graveolens</i> | <i>Cavariella aegopodii</i> |
| <i>Anisum sativum</i> | <i>Cavariella aegopodii</i> |
| <i>Coriandrum sativum</i> | <i>Rhopalosiphum rufiabdominalis</i> |
| <i>Daucus carota</i> | <i>Dysaphis foeniculus</i> |
| <i>Foeniculum vulgare</i> | <i>Dysaphis foeniculus</i> |
| <i>Petroselinum crispum</i> | <i>Cavariella aegopodii</i> , <i>Dysaphis apiifolia</i> , <i>Hyadaphis coriandri</i> , <i>Myzus persicae</i> |
| Family Apocynaceae | |
| <i>Catharanthus roseus</i> | <i>Aphis gossypii</i> , <i>Macrosiphum euphorbiae</i> |
| <i>Nerium oleander</i> | <i>Aphis fabae fabae</i> , <i>Aphis nerii</i> |
| Family Arecaceae (Palmae) | |
| <i>Phoenix dactylifera</i> | <i>Hysteroneura setariae</i> |
| Family Asclepiadaceae | |
| <i>Calotropis procera</i> | <i>Aphis nerii</i> , <i>Brachyunguis harmalae</i> |
| <i>Pergularia tomentosa</i> | <i>Aphis nerii</i> |
| Family Asteraceae (Compositae) | |
| <i>Calendula officinalis</i> | <i>Aphis gossypii</i> , <i>Uroleucon compositae</i> |
| <i>Carthamus tinctorius</i> | <i>Uroleucon jaceae</i> |
| <i>Centaurea moschata</i> | <i>Uroleucon compositae</i> |
| <i>Chrysanthemum leucanthemum</i> | <i>Aphis gossypii</i> |
| <i>Euryops arabicus</i> | <i>Brachycaudus helichrysi</i> , <i>Myzus persicae</i> |
| <i>Gazania splendens</i> | <i>Aphis craccivora</i> |
| <i>Helianthus annuus</i> | <i>Aphis armoraciae</i> , <i>Aphis gossypii</i> , <i>Brachycaudus helichrysi</i> , <i>Macrosiphum euphorbiae</i> , <i>Myzus persicae</i> |
| <i>Lactuca sativa</i> | <i>Acyrtosiphon lactucae</i> , <i>Macrosiphum euphorbiae</i> , <i>Myzus persicae</i> , <i>Nasonovia ribis-nigri</i> |
| <i>Lactuca saligna</i> | <i>Macrosiphum euphorbiae</i> |
| <i>Sonchus oleraceus</i> | <i>Hyperomyzus lactucae</i> , <i>Uroleucon sonchi</i> |
| <i>Tagetes patula</i> | <i>Myzus persicae</i> |
| <i>Verbesinia encelioides</i> | <i>Aphis fabae fabae</i> , <i>Macrosiphum euphorbiae</i> |
| Family Bignoniaceae | |
| <i>Tecoma stans</i> | <i>Aphis craccivora</i> , <i>Aphis gossypii</i> , <i>Aphis fabae fabae</i> |
| Family Boraginaceae | |
| <i>Alkanna orientalis</i> | <i>Macrosiphum euphorbiae</i> |
| <i>Heliotropium bacciferum</i> | <i>Myzus persicae</i> |
| Family Brassicaceae (Cruciferae) | |
| <i>Brassica napus</i> | <i>Myzus persicae</i> |
| <i>Brassica oleracea</i> | <i>Aphis gossypii</i> , <i>Brevicoryne brassicae</i> , <i>Lipaphis erysimi</i> , <i>Myzus persicae</i> |
| <i>Brassica rapa</i> | <i>Aphis craccivora</i> , <i>Brevicoryne brassicae</i> , <i>Lipaphis erysimi</i> , <i>Myzus persicae</i> |
| <i>Eruca sativa</i> | <i>Myzus persicae</i> |
| <i>Raphanus sativus</i> | <i>Aphis craccivora</i> , <i>Lipaphis erysimi</i> , <i>Myzus persicae</i> |
| Family Cannaceae | |
| <i>Canna indica</i> | <i>Macrosiphum euphorbiae</i> |
| Family Caryophyllaceae | |
| <i>Dianthus caryophyllus</i> | <i>Aphis fabae fabae</i> |
| Family Chenopodiaceae | |
| <i>Beta vulgaris</i> | <i>Aphis fabae fabae</i> |

| Host plants | Aphid species |
|-----------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|
| <i>Beta vulgaris</i> var. <i>cicla</i> | <i>Myzus persicae</i> |
| <i>Chenopodium ambrosioides</i> | <i>Aphis craccivora</i> , <i>Aphis gossypii</i> |
| <i>Chenopodium murale</i> | <i>Macrosiphum euphorbiae</i> |
| <i>Spinacia oleracea</i> | <i>Myzus persicae</i> |
| Family Convolvulaceae | |
| <i>Convolvulus arvensis</i> | <i>Aphis gossypii</i> , <i>Macrosiphum euphorbiae</i> , <i>Myzus persicae</i> |
| <i>Convolvulus</i> sp. | <i>Myzus persicae</i> |
| <i>Ipomoea</i> sp. | <i>Macrosiphum euphorbiae</i> , <i>Myzus persicae</i> |
| Family Cucurbitaceae | |
| <i>Citrullus colocynthis</i> | <i>Aphis gossypii</i> |
| <i>Cucurbita pepo</i> | <i>Aphis craccivora</i> , <i>Aphis fabae fabae</i> , <i>Aphis gossypii</i> |
| <i>Cucurbita</i> sp. | <i>Aphis craccivora</i> , <i>Aphis gossypii</i> |
| <i>Cucumis</i> sp. | <i>Aphis gossypii</i> |
| Family Cyperaceae | |
| <i>Cyperus rotundus</i> | <i>Saltusaphis scirpus</i> , <i>Schizaphis rotundiventris</i> |
| Family Euphorbiaceae | |
| <i>Euphorbia granulata</i> | <i>Aphis hillerislambersi</i> |
| <i>Euphorbia schimperiana</i> | <i>Aphis hillerislambersi</i> |
| Family Fabaceae (Leguminosae) | |
| <i>Clitoria</i> sp. | <i>Aphis craccivora</i> |
| <i>Dolichos lablab</i> | <i>Acyrtosiphon gossypii</i> , <i>Aphis craccivora</i> , <i>Aphis gossypii</i> , <i>Macrosiphum euphorbiae</i> |
| <i>Medicago sativa</i> | <i>Acyrtosiphon kondoi</i> , <i>Aphis craccivora</i> , <i>Therioaphis trifolii</i> |
| <i>Melilotus indica</i> | <i>Aphis craccivora</i> |
| <i>Phaseolus vulgaris</i> | <i>Aphis craccivora</i> |
| <i>Pisum sativum</i> | <i>Macrosiphum euphorbiae</i> , <i>Myzus persicae</i> |
| <i>Trigonella foenum-graecum</i> | <i>Aphis fabae fabae</i> |
| <i>Vicia faba</i> | <i>Acyrtosiphon gossypii</i> , <i>Acyrtosiphon pisum</i> , <i>Aphis craccivora</i> , <i>Aphis fabae fabae</i> |
| <i>Vigna unguiculata</i> (= <i>V. sinensis</i>) | <i>Aphis craccivora</i> |
| Family Geraniaceae | |
| <i>Pelargonium</i> sp. | <i>Aphis fabae fabae</i> |
| Family Lamiaceae (Labiatae) | |
| <i>Ocimum basilicum</i> | <i>Aphis craccivora</i> , <i>Aphis gossypii</i> , <i>Myzus ornatus</i> , <i>Ovatus crataegarius</i> |
| <i>Mentha longifolia</i> | <i>Aphis affinis</i> |
| <i>Mentha piperata</i> | <i>Aphis affinis</i> , <i>Aphis gossypii</i> |
| <i>Salvia splendens</i> | <i>Aphis gossypii</i> |
| Family Liliaceae | |
| <i>Aloe vera</i> | <i>Aphis craccivora</i> , <i>Aphis gossypii</i> |
| <i>Chlorophytum sternbergianum</i> (= <i>C. comosum</i>) | <i>Aphis craccivora</i> , <i>Aphis fabae fabae</i> |
| Family Loranthaceae | |
| <i>Phragmanthera regularis</i> | <i>Aphis gossypii</i> , <i>Sitobion asirum</i> |
| Family Lythraceae | |
| <i>Lawsonia inermis</i> (= <i>L. alba</i>) | <i>Aphis craccivora</i> , <i>Aphis nasturtii</i> |
| Family Malvaceae | |
| <i>Althaea rosea</i> | <i>Myzus persicae</i> |
| <i>Gossypium</i> sp. | <i>Aphis gossypii</i> |
| <i>Hibiscus esculentus</i> | <i>Aphis gossypii</i> |
| <i>Hibiscus rosa-sinensis</i> | <i>Aphis gossypii</i> , <i>Myzus persicae</i> |
| <i>Malva parviflora</i> | <i>Aphis gossypii</i> , <i>Myzus persicae</i> |
| <i>Malvaviscus arboreus</i> (= <i>M. mollis</i>) | <i>Myzus persicae</i> |
| Family Mimosaceae (Leguminosae) | |
| <i>Pithecellobium dulce</i> | <i>Aphis craccivora</i> |
| <i>Prosopis juliflora</i> | <i>Aphis craccivora</i> , <i>Brachyunguis harmalae</i> |
| Family Moraceae | |
| <i>Ficus carica</i> | <i>Aphis gossypii</i> |
| <i>Ficus</i> sp. | <i>Aphis craccivora</i> , <i>Aphis gossypii</i> , <i>Sitobion africanum</i> |
| <i>Morus alba</i> | <i>Macrosiphum euphorbiae</i> |

| Host plants | Aphid species |
|-----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Family Myoporaceae | |
| <i>Myoporum laetum</i> | <i>Aphis gossypii</i> |
| Family Neuradaceae | |
| <i>Neurada procumbens</i> | <i>Aphis craccivora</i> |
| Family Nyctaginaceae | |
| <i>Bougainvillea spectabilis</i> | <i>Myzus persicae</i> |
| Family Oleaceae | |
| <i>Jasminum sambac</i> | <i>Aphis craccivora</i> |
| Family Pinaceae | |
| <i>Pinus halepensis</i> | <i>Cinara maghrebica</i> |
| Family Pittosporaceae | |
| <i>Pittosporum tobira</i> | <i>Aphis gossypii</i> , <i>Macrosiphum euphorbiae</i> |
| Family Plantaginaceae | |
| <i>Plantago lanceolata</i> | <i>Myzus persicae</i> |
| Family Poaceae (Gramineae) | |
| <i>Aristida adscensionis</i> | <i>Rhopalosiphum maidis</i> |
| <i>Arundo donax</i> | <i>Hyalopterus pruni</i> , <i>Hysteroneura setariae</i> , <i>Melanaphis sacchari</i> |
| <i>Avena futua</i> | <i>Metopolophium dirhodum</i> |
| <i>Avena sativa</i> | <i>Metopolophium dirhodum</i> , <i>Schizaphis graminum</i> , <i>Sitobion fragariae</i> |
| <i>Chloris virgata</i> | <i>Rhopalosiphum maidis</i> |
| <i>Cynodon dactylon</i> | <i>Hysteroneura setariae</i> |
| <i>Dactyloctenium aegyptium</i> | <i>Hysteroneura setariae</i> |
| <i>Echinochola colona</i> | <i>Rhopalosiphum maidis</i> |
| <i>Eragrostis</i> sp. | <i>Hysteroneura setariae</i> , <i>Rhopalosiphum maidis</i> |
| <i>Hordeum vulgare</i> | <i>Melanaphis sacchari</i> , <i>Metopolophium festucae cerealium</i> , <i>Rhopalosiphum maidis</i> , <i>Rhopalosiphum padi</i> , <i>Schizaphis graminum</i> |
| <i>Latipes senegalensis</i> | <i>Rhopalosiphum maidis</i> |
| <i>Panicum coloratum</i> | <i>Rhopalosiphum maidis</i> |
| <i>Panicum turgidum</i> | <i>Hysteroneura setariae</i> |
| <i>Pennisetum typhoides</i> | <i>Hysteroneura setariae</i> , <i>Pseudaphis</i> sp., <i>Rhopalosiphum maidis</i> |
| <i>Pennisetum setaceum</i> | <i>Pseudaphis abyssinica</i> , <i>Sitobion africanum</i> |
| <i>Phalaris minor</i> | <i>Hysteroneura setariae</i> , <i>Rhopalosiphum rufiabdominalis</i> |
| <i>Saccharum officinarum</i> | <i>Rhopalosiphum maidis</i> |
| <i>Setaria verticillata</i> | <i>Sitobion avenae</i> |
| <i>Setaria viridis</i> | <i>Rhopalosiphum maidis</i> |
| <i>Sorghum vulgare</i> | <i>Melanaphis sacchari</i> , <i>Rhopalosiphum maidis</i> |
| <i>Sorghum sudanense</i> | <i>Melanaphis sacchari</i> , <i>Rhopalosiphum maidis</i> |
| <i>Triticum aestivum</i> | <i>Metopolophium dirhodum</i> , <i>Metopolophium festucae cerealium</i> , <i>Rhopalosiphum</i> <i>maidis</i> , <i>Rhopalosiphum padi</i> , <i>Schizaphis graminum</i> , <i>Sitobion avenae</i> , <i>Sitobion fragariae</i> |
| <i>Zea mays</i> | <i>Melanaphis sacchari</i> , <i>Rhopalosiphum maidis</i> , <i>Rhopalosiphum padi</i> , <i>Schizaphis</i> <i>graminum</i> |
| Family Polygonaceae | |
| <i>Rumex obtusifolius</i> | <i>Aphis fabae fabae</i> , <i>Brachycaudus rumexicolens</i> , <i>Dysaphis emicis</i> |
| <i>Rumex nervosus</i> | <i>Aphis nasturtii</i> |
| Family Portulacaceae | |
| <i>Portulaca oleracea</i> | <i>Aphis craccivora</i> |
| Family Punicaceae | |
| <i>Punica granatum</i> | <i>Aphis gossypii</i> , <i>Aphis punicae</i> |
| Family Rosaceae | |
| <i>Malus silvestris</i> | <i>Eriosoma lanigerum</i> , <i>Macrosiphum euphorbiae</i> , <i>Ovatus crataegarius</i> |
| <i>Prunus armeniaca</i> | <i>Aphis craccivora</i> , <i>Aphis gossypii</i> , <i>Hyalopterus pruni</i> , <i>Macrosiphum euphorbiae</i> |
| <i>Prunus domestica</i> | <i>Pterochloroides persicae</i> |
| <i>Prunus persica</i> | <i>Brachycaudus helichrysi</i> , <i>Hyalopterus amygdali</i> , <i>Hyalopterus pruni</i> , <i>Myzus</i> <i>persicae</i> , <i>Pterochloroides persicae</i> |
| <i>Prunus spinosa</i> | <i>Pterochloroides persicae</i> |

| Host plants | Aphid species |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>Rosa</i> sp. | <i>Macrosiphum euphorbiae</i> , <i>Macrosiphum rosae</i> , <i>Myzus persicae</i> , <i>Rhodobium porosum</i> |
| Family Rutaceae <i>Citrus</i> sp. | <i>Aphis craccivora</i> , <i>Aphis fabae fabae</i> , <i>Aphis gossypii</i> , <i>Aphis spiraeicola</i> , <i>Macrosiphum euphorbiae</i> , <i>Myzus persicae</i> |
| Family Sapindaceae <i>Dodonea viscosa</i> | <i>Aphis fabae fabae</i> , <i>Hysteroneura setariae</i> |
| Family Scrophulariaceae <i>Antirrhinum majus</i> | <i>Brevicoryne brassicae</i> |
| Family Solanaceae <i>Capsicum frutescens</i> <i>Cestrum nocturnum</i> <i>Lycium arabicum</i> <i>Lycopersicum esculentum</i> <i>Petunia hybrida</i> <i>Physallis longifolia</i> <i>Solanum melongena</i> <i>Solanum nigrum</i> <i>Solanum tuberosum</i> <i>Withania somnifera</i> | <i>Aphis craccivora</i> , <i>Aphis gossypii</i> , <i>Myzus persicae</i> <i>Aphis craccivora</i> , <i>Aphis fabae fabae</i> , <i>Myzus persicae</i> <i>Macrosiphum euphorbiae</i> <i>Macrosiphum euphorbiae</i> , <i>Myzus persicae</i> <i>Myzus persicae</i> <i>Aphis fabae fabae</i> , <i>Aphis nasturtii</i> <i>Aphis gossypii</i> , <i>Myzus persicae</i> <i>Aphis fabae solanella</i> <i>Aphis gossypii</i> , <i>Myzus persicae</i> <i>Aphis gossypii</i> |
| Family Tamaricaceae <i>Tamarix</i> sp. | <i>Brachyunguis tamaricis</i> |
| Family Typhaceae <i>Typha</i> sp. | <i>Paraschizaphis rosazevedoi</i> |
| Family Urticaceae <i>Urtica urens</i> | <i>Myzus persicae</i> |
| Family Verbenaceae <i>Clerodendron inerme</i> | <i>Myzus persicae</i> |
| Family Vitidaceae <i>Vitis vinifera</i> | <i>Aphis gossypii</i> |
| Family Zygophyllaceae <i>Tribulus pentandrus</i> | <i>Aphis gossypii</i> |

Notes on the Tiger Beetle Fauna of the Sultanate of Oman (Coleoptera: Cicindelidae)¹

Fabio Cassola and Abdeslam Rihane

Abstract: A preliminary list is given of the twelve tiger beetle species known so far from the Sultanate of Oman, based mainly on the second author's recent collecting in the southern region of Dhofar. Ten of these species are recorded for the first time from Oman.

ملاحظات عن مجموعة الخنافس النمرية في سلطنة عُمان
(رتبة غمدية الاجنحه : عائلة الخنافس النمرية)

فايو كاسولا و عبد السلام ريان

خلاصة : يتضمن هذا البحث قائمة اولية لـ ١٢ نوعاً من الخنافس النمرية التي تم تسجيلها من سلطنة عمان، مستندة على عينات جمعت حديثاً من المنطقة الجنوبية لظفار. أن ١٠ من هذه الأنواع يتم تسجيلها لأول مرة من عُمان.

INTRODUCTION

The cicindelid fauna of the huge, arid Arabian Peninsula is still poorly known, due to a lack of appropriate specialised research. What is known comes from only a few papers, namely from BRITTON (1948), who reported on nine tiger beetle species collected from several areas in south-west Arabia (Yemen, Hijaz, Aden and Asir) and BASILEWSKY (1964, 1968, 1978), who provided some additional data on four species from Yemen and southern Arabia. ALI (1978) added some further records, mostly with incorrect names (MANDL 1981), from the Red Sea area and AL-HOUTY (1989) recorded five species from Kuwait, unfortunately also with incorrect names. Finally, WRANIK et al. (1991) reviewed the tiger beetle fauna of Yemen and WIESNER (1993) recently reported six species from the United Arab Emirates.

Virtually nothing was known from the Sultanate of Oman, apart from a single record of *Lophyridia aulica* (Dejean, 1831) from Muscat, based on a specimen collected by A.S.G. Jayakar (BRITTON 1948), and a record of *Lophyra histrio* (Tschitschérine, 1903) from Masirah Island (WRANIK et al. 1991). Therefore the data given here, based mainly on a two-year cooperative mission by the second author to Oman, represent the first real insight into the tiger beetle fauna of

¹ Studies on Tiger Beetles, LXXVIII

this east Arabian region (Fig. 1). It is supplemented by specimens from the collection in the Oman Natural History Museum, Muscat (ONHM), the Natural History Museum, London (BMNH), and others retained in M.P.T. Gillett's collection (MG; Abu Dhabi, U.A.E.) and in the first author's

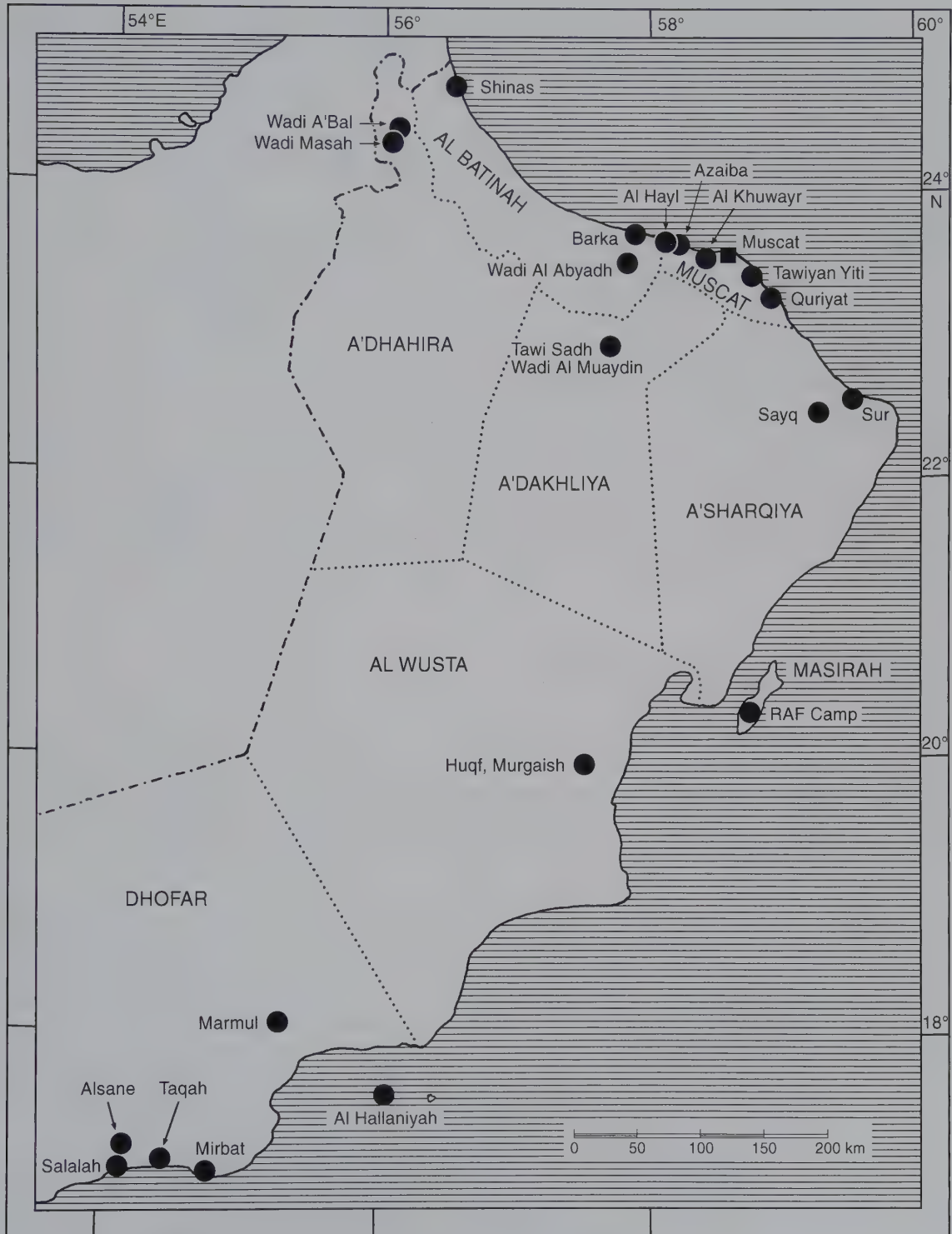


Fig. 1: Map of the Sultanate of Oman with regional subdivisions and main collecting localities.

collection (FC). Three tiger beetle species have been recorded independently from Oman in a recent article by GILLET (in press).

In the following list, localities are arranged from north to south, according to their respective administrative regions (Al Wusta, Dhofar, etc.; see Fig. 1). As far as possible, coordinates are given. The orthography used corresponds with Oman's official maps and conventions.

The local term "khawr" designates a tidal creek or lagoon (except those with mangroves), while the term "qurm" indicates the mangrove *Avicennia marina* and, in Dhofar, the saline creeks in which it grows.

SYSTEMATIC ACCOUNT

Megacephala (Grammognatha) euphratica euphratica Latreille et Dejean, 1822 (Plate 1)

Megacephala euphratica Latreille & Dejean, 1822. — Hist. nat. Icon. Coléopt. d'Europe 37: Tab. 1, Fig. 4 ["Trouvée sur les bords de l'Euphrate par feu M. Olivier"].

Material: A'Sharqiya: 1 ex., N of Sur, Khawr Gkamah, 22°37'00"N 59°27'50"E, creek about 300 m away from the sea, 23.X.1995, M.W. Balkenohl & M.D. Gallagher, ONHM.

The only *Megacephala* species inhabiting the Palaearctic region, *M. euphratica* is widely but discontinuously distributed from SE Spain and the Atlantic coast of Morocco and Mauritania eastwards through the whole of North Africa, the Mediterranean islands of Crete, Cyprus and Rhodes, the Red Sea coast (south to Yemen and Djibouti), Palestine, Jordan and Mesopotamia (CASSOLA 1981), and it was recently recorded from Kuwait (AL-HOUTY 1989) and the United Arab Emirates (WIESNER 1993). The species also occurs from Iran eastwards to Central Asia, represented by its bluish subspecies *M. e. armenica* Castelnau, 1834 (KRYZHANOVSKIY et al. 1995). New record for Oman.

Lophyridia aulica (Dejean, 1831) (Plate 2)

Cicindela aulica Dejean, 1831. — Species Coléopt. 5: 250 ["Sénégal"].

Lophyridia aulica. — Rivalier 1950; Rev. fr. Ent. 17: 238.

Material: Muscat: 6 exs, Azaiba (Adhiba), 23°36'N 58°36'E, 21.IV.1989, M.D. Gallagher, 4 ONHM, 2 FC; 61 exs, Azaiba Creek, 23°37'N 58°18'E, at light, 30.V.1995, M.D. Gallagher, ONHM, FC; 2 exs, Azaiba, creek, 23°37'N 58°18'E, 15.X.1995, M.W. Balkenohl, ONHM; 24 exs, N of Quriyat, 23°16'N 58°55'E, at light, 1.VI.1995, M.D. Gallagher, ONHM, FC; 11 exs, Quriyat, 23°17'N 58°56'E, creek (*Avicennia marina*), 26.X.1995, M.W. Balkenohl & M.D. Gallagher, 8 ONHM, 3 FC. — Al Wusta: 3 exs, Huqf, Murgaish (Murjaysh), 19°43'N 57°21'E, 22.IV.1982, C.F. Dewhurst, 2 ONHM, 1 FC. — Dhofar: 1 ex., Salalah, 16°59'N 54°04'E, 10 m, 19-20.VII.1995, B.J. Skule, ONHM; many exs, Khawr Sanur, 17°03'N 54°31'E, 6.X.1994, A. Rihane; many exs, Rzat and Sha'a Qurms, 17°03'N 54°17'E, 1.XII.1994, A. Rihane; many exs, Khawr Rawri, 24.VI.1993, 11.VII.1993, 12.VIII.1993, A. Rihane; 2 exs, Taqah, mangrove marsh, 17°02'N 54°24'E, 20.IX.1988, M.J. Ebejer, ONHM; many exs, Khawr Taqah, 11.VII.1993, 12.VIII.1993, 19.V.1994, 22.IX.1994, 6.X.1994, 13.X.1994, 20.X.1994, 27-28.X.1994, 10.XI.1994, 17.XI.1994, A. Rihane; many exs, Khawr Sawli, 23.IX.1993, A. Rihane; many exs, Khawr Dahariz, E of Salalah, 21.IX.1992, 16.VII.1993, 15.VIII.1993, 3.III.1994, 25.VIII.1994, 18.IX.1994, A. Rihane; many exs, Qurms 1 and 2 (W of Salalah), 22.VI.1993, 8.VII.1993, 10.II.1994, 16.III.1994, 24.VIII.1994, A. Rihane; many exs, Khawr Fidkhayt, 4.VIII.1993, 21.IX.1993, 18.XI.1993, 10.II.1994, 16.III.1994, 20.X.1994, 24.XI.1994, A. Rihane; many exs, Khawr Mughsyl, 10.XII.1992, 11.II.1993, 18.III.1993, 29.IV.1993, 20.V.1993, 8.VII.1993, 21.X.1993, 18.XI.1993, 16.III.1994, 20.X.1994, 24.XI.1994, A. Rihane; many exs, Mughsyl Spring, 16.III.1994, 24.XI.1994, A. Rihane; 3 exs, Al Hallaniyah (Kuria Muria Island), 17°30'N 56°05'E, 24.III.1995, R.G. Moolenbeek, 2 ONHM, 1 FC.

A mainly Palaearctic species, widely but discontinuously distributed from Western and Mediterranean Africa to the Middle East (east to Pakistan), to the Red Sea and south to Yemen, Aden and Somalia (CASSOLA 1985, CASSOLA & MISKELL 1990). As to the Arabian Peninsula, it was previously recorded from the Red Sea coast, the Hadhramaut (BRITTON 1948), Bahrain (ALI 1978), the United Arab Emirates (WIESNER 1993), and Oman itself (BRITTON 1948, WRANIK et al. 1991).

A typical halophilous element, *L. aulica* inhabits saline environments such as saltpans and lagoons. In the plain of Dhofar, it was found on the sea side shores of the khawrs and lagoons, where the density of this species was sometimes very high (RIHANE, in prep. a). The specimens show some variation in elytral markings (RIHANE, in prep. b) and mostly are unusually small in size (8-10 mm).

Lophyridia diania (Tschitschérine, 1903) (Plate 3)

Cicindela aulica diania Tschitschérine, 1903. — Horae Soc. entom. Ross. 36: 11, 14 ["Sarhad (Serhad): localités Hurmuk, Duz-ab et Podahi; Hudian: env. de Bazman"].

Lophyridia diania. — Naviaux, 1983; L'Entomologiste, 39: 239.

Material: A'Dhahira: 4 exs, Wadi Aboule, 24°27'N 56°04'E, 8.VI.1995, M.P.T. Gillett, 3 MG, 1 FC; 1 ex., Wadi A'Bal, 24°26'N 56°03'E, 11.VI.1993, M.P.T. Gillett, ONHM.

This interesting species, described from south-eastern Iran as a subspecies of *L. aulica*, was correctly raised to full specific status by NAVIAUX (1983). Apart from the blue body colour and several other morphological features, it is apparently, unlike *L. aulica*, a riverine freshwater species. *L. diania* was recently also collected in western Baluchistan (2 exs, Turbat, 8-19.IV.1993, S. Becvar, FC) and it was also recorded from Iraq (WIESNER 1992). Its discovery in northern Oman therefore represents a remarkable range extension south of the Arabian Gulf and the Gulf of Oman.

Lophyridia fischeri elongatosignata (W. Horn, 1922) (Plate 4)

Cicindela fischeri Adams ssp. *elongato-signata* W. Horn, 1922. — Entomologische Mitteilungen 11: 21 ["Transkaspien (Oase Tedschen)"].

Lophyridia fischeri. — Rivalier 1950; Rev. fr. Ent. 17: 238.

Material: A'Dhahira: 3 exs, Wadi Masah, 24°21'N 56°02'E, 4.VI.1993, M.P.T. Gillett, 2 ONHM, 1 FC; 11 exs, Wadi Aboule, 24°22'N 56°05'E, 4.IV.1993, 20.V.1993, 4.VI.1993, 25.XI.1994, M.P.T. Gillett, 8 MG, 3 FC; 9 exs, Wadi A'Bal, 24°26'N 56°03'E, 9.IV.1993 and 11.VI.1993, M.P.T. Gillett, 7 ONHM, 2 FC. — A'Dakhliya: 2 exs, Tawi Sadh, Wadi Al Muaydin, 22°56'N 57°41'E, 22.IV.1988, M.D. Gallagher & H. Hölzel, 1 ONHM, 1 FC.

New for Oman and for the whole Arabian Peninsula. The species is known from Greece to Turkey, Armenia and southern Russia (*L. f. fischeri*) and from Iran east to Afghanistan, Tadjikistan and the southern coast of Pakistan (*L. f. elongatosignata*) (WIESNER 1992). The specimen illustrated by AL-HOUTY (1989: photo 126) with the incorrect name "*Cicindela nemoralis* Oliv." is most probably also *L. fischeri*. The species' occurrence in Oman represents therefore an interesting range extension. The colour of nearly all specimens examined is reddish-bronze with small green punctures; however, a few specimens from Wadi Aboule are darker in colour.

Lophyra (Lophyra) histrio (Tschitschérine, 1903) (Plate 5)

Cicindela histrio Tschitschérine, 1903. — Horae Soc. entom. Rossicae 36: 16 ["Chorasan, région Zirkuh: massif de Bamrud"].

Lophyra histrio. — Rivalier 1950; Rev. fr. Ent. 15: 70.

Material: Al Batinah: 1 ex., Wadi Al Abyadh, 23°25'N 57°40'E, 250 m, 30.III.1990, M.D. Gallagher, FC. — A'Dhahira: 3 exs, Wadi Aboule, 24°22'N 56°05'E, 9.IV.1993 and 8.VI.1995, M.P.T. Gillett, 2 MG, 1 FC. — Muscat: 3 exs, Al Khuwayt, 23°36'N 58°26'E, 2-13.IV.1989, M.D. Gallagher, 2 ONHM, 1 FC; 1 ex., near Quriyat, 23°10'N 58°53'E, 100 m, at light in foothills, 12.III.1990, M.D. Gallagher, ONHM; 1 ex., Azaiba Creek, 23°37'N 58°18'E, at light, 30.V.1995, M.D. Gallagher, ONHM; 1 ex., Al Hayl, 23°39'N 58°12'E, to light, 25-27.VI.1995, B.J. Skule, ONHM. — A'Sharqiya: 1 ex., eastern Hajar mountains, Sayq, 22°30'N 59°06'E, 540 m, to light in wadi, 5-6.VII.1995, B.J. Skule & M.D. Gallagher, ONHM. — Masirah: 2 exs, Masirah Island, RAF Camp, 15-19.IV.1976, K. Guichard, 1 BMNH, 1 FC.

A Middle Eastern species known so far from Iran, Afghanistan, Pakistan (Sind, Karachi) and India (Rajasthan). More recently, WIESNER (1993) recorded it from the United Arab Emirates as well. The Masirah Island record had already been published by WRANIK et al. (1991), but it was apparently overlooked in WIESNER's (1992) catalogue.



***Cephalota (Taenidia) littorea alboreducta* (W. Horn, 1934) (Plate 6)**

Cicindela littorea Forskål, 1775. — Descriptiones Animalium: 77 ["Suez"].

Cicindela litorea alboreducta W. Horn, 1934. — Bull. mens. Soc. Natur. Luxemb. (N.S.) 28: 73 ["Obock; Djibuti"].

Cephalota (Taenidia) litorea. — Rivalier 1950; Rev. fr. Ent. 17: 229.

Material: 6 exs, Dhofar, Khawr Dahariz, 16.VII.1993, 25.VIII.1994, A. Rihane.

A revision and a taxonomic review of this species and its closely allied *C. (T.) tibialis* (Dejean, 1822), was recently given by GEBERT (1991), who also indicated, for the nominal form *C. l. littorea*, an unnamed locality (island?) off the coast of southern Oman, east of Salalah, in the distribution map (but not in the text) of his paper. The specimens examined, however, mainly because of their greenish-bronze colouration and the margins of elytra conspicuously dilated in females, may be ascribed to *C. l. alboreducta*, which was described from Obock and Djibouti (HORN 1934) and was later recorded from northern Somalia (CASSOLA & MISKELL 1990), Yemen (WRANIK et al. 1991) and the southern Saudi Arabian Red Sea coast (GEBERT 1991). New record for Oman.

A typical halophilous element, to be found in salt pans and on shores of lagoons. In July 1993 mating pairs were observed, while in August 1994 only solitary individuals were seen.

***Myriochile (Myriochile) melancholica melancholica* (Fabricius, 1798) (Plate 7)**

Cicindela melancholica Fabricius, 1798. — Ent. Syst. Suppl.: 63 ["Habitat in Guinea"].

Myriochile (s. str.) *melancholica*. — Rivalier 1950; Rev. fr. Ent. 17: 234.

Material: Al Batinah: 1 ex., Barka, 23°40'N 57°51'E, 10 m, at light in farm, 3-4.III.1993, Hattangadi & M.D. Gallagher, ONHM; near Barka, 23°40'50"N 57°50'40"E, 50 m, to light on farm, 4-5.VIII.1994, M.D. Gallagher, ONHM. — Muscat: 2 exs, Quriyat, 23°14'N 58°55'E, 12 m, at light in dunes, 18.VI.1993, M.D. Gallagher, 1 ONHM, 1 FC; 1 ex., Al Hayl, 23°39'N 58°12'E, to light, 25-27.VI.1995, B.J. Skule, FC; 1 ex., Tawiyani Yiti, 23°30'N 58°39'E, 40 m, cultivations and shrubs, at light, 11.V.1990, M.D. Gallagher, ONHM. — Dhofar: 1 ex., Marmul, Desert Agric. Project, 5.VI.1991, A. Edgeley, ONHM; many exs, Khawr Sanur, 6.X.1994, A. Rihane; many exs, Khawr Rawri, 24.VI.1993, 11.VII.1993, 15.III.1994, A. Rihane; many exs., Khawr Taqah, 15.V.1994, 13.X.1994, 27.X.1994, 10.XI.1994, A. Rihane; many exs, Khawr Dahariz, 21.IX.1992, A. Rihane; many exs, Qurms 1 and 2 (Qurm as Saghir, Qurm al Kabir), 10.II.1994, 16.III.1994, A. Rihane; many exs, Khawr Fidkhayt, 13.V.1993, A. Rihane; many exs, Khawr Mughsyl, 10.XII.1992, 11.II.1993, 18.III.1993, 13.V.1993, 20.X.1994, A. Rihane; many exs, Mughsyl Spring, 16.III.1994, 24.XI.1994, A. Rihane; 1 ex., Nabi Allah Ayoub, 23.VIII.1994, A. Rihane; 1 ex., Tobruk spring and stream, 23.IX.1994, A. Rihane.

A common, widely distributed species ranging from the whole African continent to southern Europe and eastwards to northern India (CASSOLA & MISKELL 1990). However, it was not formerly known from Oman. Despite its enormous range, this species shows very little variation.

***Myriochile (Monelica) hauseri* (W. Horn, 1898) (Plate 8)**

Cicindela Hauseri W. Horn, 1898. — Not. Leyden Mus. 20: 105 ["Ikutha: British East Africa"].

Myriochile (Monelica) Hauseri. — Rivalier 1957; Rev. fr. Ent. 24: 323.

Material: Dhofar: 6 exs, Al Saan (Alsane), Jabal Qara, 17°09'N 54°14'E, 700 m, VII.1993 (small densities noticed in VIII.1994), A. Rihane; 2 exs, Madinat al Saan, Jabal Qara, 17°11'N 54°15'E, 700 m, VII.1993, A. Rihane, ONHM; 7 exs, Tobruk spring and stream, 17°06'N 54°23'E, 27.X.1994, 17.XI.1994, A. Rihane; 2 exs, N of Salalah, 17°08'N 54°07'E, 350 m, 21.VII.1995, B.J. Skule, 1 ONHM, 1 FC.

An East African element, known from Kenya, Ethiopia and Somalia (CASSOLA & MISKELL 1990). Its occurrence in the Arabian Peninsula is recorded here for the first time and is most interesting. However, the taxonomy of the species is far from being clear (WIESNER 1992). WERNER

(1993) has recently reinstated both *M. jucunda* (Péringuey, 1892) and *M. deprimozi* (Babault, 1921) from synonymy with *M. fastidiosa vicina* (Dejean, 1831) and *M. hauseri* respectively, and stated that Péringuey's type specimen, supposedly coming from A.W. Erichson's findings in "Northern Ovamboland" (PÉRINGUEY 1892), lacks any locality label and could well have been collected in East Africa. According to WERNER (1993), *M. jucunda* should be easily distinguishable from *M. hauseri* by its deep green colouration (*M. hauseri* being mostly reddish-brown) and it should occur in Kenya, Somalia and possibly in Sudan. More recently, however, WERNER & WIESNER (1994) have again considered *M. jucunda* as inhabiting Namibia only.

The specimens from Oman, which are mostly deep green, should therefore be considered to be *M. jucunda* or, if this name should prove to be unavailable, a separate new species. However, further taxonomic work is clearly needed on the group, based on more material from the whole area.

This species was active on the southern slopes of the Dhofar Mountains, during the SW monsoon between June and September. Small numbers were also seen on the shores of Tobruk stream near to the spring. Some mating pairs were observed by the second author in July 1993 on wet vegetation.

Hypaetha immanis (Bates, 1874) (Plate 9)

Cicindela immanis Bates, 1874. — Ent. Monthly Mag. 10: 266 ["Yemen"].

Hypaetha immanis. — Rivalier 1950; Rev. fr. Ent. 17: 242.

Material: Dhofar: 10 exs, beach between Taqah and Mughsyl, A. Rihane; many exs, Taqah Beach, 19.V.1994, 13.X.1994, A. Rihane; many exs, Dahariz Beach, X.1994, A. Rihane; many exs, Mughsyl Beach, III-IV.1993, 30.XI.1994, A. Rihane, 1 ONHM.

Described from "Yemen", this species represents an interesting South Arabian endemic, known so far only from the Aden area (WRANIK et al. 1991, WIESNER 1992). It is new for the fauna of Oman.

Hypaetha singularis (Chaudoir, 1876) (Plate 10)

Cicindela singularis Chaudoir, 1876. — Rev. Mag. Zool. 39: 330 ["Ile de Dalak dans la Mer Rouge"].

Hypaetha singularis. — Rivalier 1950; Rev. fr. Ent. 17: 242.

Material: Dhofar: many exs, sea shore between Mirbat (Marbat) and Mughsyl (Khawr Taqah, Taqah Beach and Khawr Sawli), 19.V.1994, 13.X.1994, 10.XI.1994, A. Rihane; many exs, Qurms 1 and 2 (Qurm as Saghir, Qurm al Kabir) and sea shore, 16.III.1994, 24.IV.1994, 13.X.1994, A. Rihane; many exs, Khawr Fidkhayt, Khawr Mughsyl and Mughsyl Beach, 1-31.III.1993, 4.VIII.1993, 18.IX.1993, 13.I.1994, 16.III.1994, 20.X.1994, 24.X.1994, A. Rihane, 1 ONHM.

This species is known to occur on both sides of the Red Sea and the Gulf of Aden, from Egypt and Sinai south to Eritrea, Yemen and northern Somalia (CASSOLA & MISKELL 1990, WRANIK et al. 1991). It is new for the fauna of Oman.

H. singularis lives with *H. immanis* on the sea shore and with *L. aulica* on the seaside of the khawrs. Specimens show little variation in the elytral markings and perfect homochromy with the sandy substrate.

Hypaetha copulata (Schmidt-Goebel, 1846) (Plate 11)

Cicindela copulata Schmidt-Goebel, 1846. — Faunula Coleopt. Birmaniae 1: 9 ["aus der Umgebung von Cossipoor bei Calcutta" (erroneous)].

Hypaetha copulata. — Rivalier 1950; Rev. fr. Ent. 17: 242.

Material: Al Batinah: 1 ex., Shinass (= Shinas), 24°43'N 56°28'E, mangrove creek and scrub, at light, 9-10.VI.1994, M.D. Gallagher, ONHM. — Muscat: 2 exs, Liva, near Sahi Harmul, 24°32'12"N 56°35'31"E, mangrove swamp (*Avicennia marina*), 10-25.X.1995, M.W. Balkenohl & M.D. Gallagher, 1 ONHM, 1 FC.

Described from "Cossipore near Calcutta" (erroneously), this species is known to occur along the southern coast of Pakistan and westward along the northern edge of the Arabian Gulf in Iran (CASSOLA 1976, ACCIAVATTI & PEARSON 1989, WIESNER 1992), and it was also recently recorded from the United Arab Emirates, not far from the border with Oman (WIESNER 1993, sub *H. c. emiratensis* n. ssp.). The specimens examined from Oman, however, do not show the broader elytral maculation described for the subspecies *H. c. emiratensis*. New record for Oman.

Salpingophora hanseatica (W. Horn, 1927) (Plate 12)

Cicindela hanseatica W. Horn, 1927. — Entomologische Mitteilungen 16: 58 ["Bender Abbas"].

Salpingophora hanseatica. — Cassola & Brouerius van Nidek 1984; *Cicindela* 16: 16.

Material: Al Batinah: 2 exs, Shinass (= Shinas), 24°43'N 56°28'E, mangrove creek and scrub, at light, 9-10.VI.1994, M.D. Gallagher, 1 ONHM, 1 FC; 5 exs, Shinas, 24°42'52"N 56°28'38"E, mangrove (*Avicennia marina*) swamp, 12.X.1995, 2' 18 W light trap, 3 ONHM, 2 FC; 1 ex., Wadi Abyadh, 23°25'04"N 57°40'22"E, 230 m, 21.XII.1994, M.D. Gallagher & B.J. Skule, ONHM.

New record for Oman. An interesting species, described from Bender Abbas on the Iranian coast. It had already been recorded from the Arabian Peninsula by WERNER (1992, Plate 53, Figs 471-472), who published colour pictures of a female paratype from Bender Abbas as well as of a male specimen from Dammam, Eastern Province, Saudi Arabia. This record, which has been questioned by WIESNER (1993), is now confirmed, since two female specimens from the same locality and collector are in the FC collection, bearing the following label data: "Saudi Arabia, E. Provs., Dammam, behind Hilton Hotel, sandy beach of Gulf adjacent to a large salt marsh, 17-20.IX.1978, J.A. Shetterly leg. (found with lantern at night, 22 p.m. to 01 a.m., 70-80 F, humid)".

Moreover, *S. hanseatica* most probably also occurs in Kuwait, since the specimen illustrated by AL-HOUTY (1989: photo 124) with the incorrect name "*Cicindela immanis* Bates" seems to be really *S. hanseatica*.

This species is obviously a close relative of *S. maindroni* (W. Horn, 1897), which is known so far only from Pakistan (Baluchistan, Sind, Karachi) (CASSOLA 1976, WIESNER 1992) and which can easily be mistaken for it. *S. hanseatica*, however, has a more squared, parallel-sided pronotum, with retracted hind corners and smaller hind tubercles (especially in females) as HORN (1927) clearly indicated. Moreover, it has to be emphasised that *S. hanseatica* females lack any apparent mesepisternal coupling sulci (whereas those of *S. maindroni* have a deep pit in the upper part of the mesepisternum) and that the male aedeagus has a more pointed apex than that of *S. maindroni* (which is slightly button-ended).

DISCUSSION

It is clear from the above mentioned data that most of the present knowledge on the tiger beetles of Oman refers to only few records. It is to be expected that future specialised research in other areas of the Sultanate, namely in the northern provinces, will lead to the discovery of additional species, for example: *Salpingophora helferi* (Schaum, 1863) or *Hypaetha schmidtii* (W. Horn, 1927) both of which are saline habitat dwellers and have been recorded recently from neighbouring areas of the United Arab Emirates (WIESNER 1993). Also an East African element, *Lophyridia alboguttata* (Klug, 1832), which is already known from the Hijaz, Saudi Arabia (BRITTON 1948), from Yemen (WRANIK et al. 1991), and was also recorded from "Arabia" (ALI 1978, sub *Cicindela euarabica* Ali;

cf. MANDL 1981), is likely to occur somewhere in southern Oman at least. It is a freshwater element, to be found on the sandy banks of inland rivers and streams.

ACKNOWLEDGEMENTS

Most sincere thanks are due to Mr. M.D. Gallagher, Curator and Adviser, Natural History Museum, Muscat, Sultanate of Oman, who collected or kindly submitted for identification all the Cicindelidae specimens of the Oman Natural History Museum. Dr. M.W. Balkenohl (Denzlingen, Germany) and Dr. Michael P.T. Gillett (United Arab Emirates University, Al Ain, Abu Dhabi) were also very kind, submitting all the tiger beetle specimens they collected recently in Oman.

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Laemostenus (*Arabosphodrus*) *balkenohli*, a New Carabid Subgenus and New Species from Oman (Coleoptera: Carabidae: Sphodrini)

Riccardo Sciaky

Abstract: *Laemostenus* (*Arabosphodrus* n. subg.) *balkenohli* n. sp. is described from Oman. This subgenus is the first endemic from the Arabian Peninsula and appears related to *Laemostenus* s. str. and *Stenosphodrus*.

Laemostenus (*Arabosphodrus*) *balkenohli*
تحت جنس ونوع جديدان من عُمان
(الحنافس : رتبة غمدية الاجنحه : مجموعة Sphodrini)

ريكاردو سياكي

خلاصة : تم وصف تحت الجنس والنوع الجديدان *Laemostenus* (*Arabosphodrus*) *balkenohli* من عُمان. ويمثل تحت الجنس هذا اول مستوطن من عائلة الحنافس في شبه الجزيرة العربية ويبدو انه يقرب من الناحية التصنيفية للجنسين *Laemostenus* و *Stenosphodrus*.

INTRODUCTION

Through the kindness of Dr. Michael Balkenohl, I have been able to examine some specimens of carabid beetles belonging to the genus *Laemostenus* Bonelli, 1810 collected in the Sultanate of Oman. Beyond its outstanding biogeographic interest (it is the second species of Sphodrini endemic to the Arabian Peninsula and the first of the phyletic line of *Laemostenus*), this species has proved to be of exceptional systematic interest, since it has not been possible to insert it into any of the many subgenera of *Laemostenus* (in the wide sense of CASALE 1988). For this reason it is necessary to erect for it a new subgenus, whose description and discussion is the subject of this work.

Genus *Laemostenus* Bonelli, 1810

Arabosphodrus n. subg.

Type species: *Laemostenus balkenohli* n. sp.

Diagnosis: A subgenus of *Laemostenus* completely depigmented and with reduced eyes, similar in general aspect to *Stenosphodrus* Casale, 1988, but much smaller, with the basal margin of

the elytra strongly concave, so that the humeral angle is moved forward with respect to the scutellum. Mesosternum not denticulate in front of mesocoxae, tarsi smooth dorsally, claws not denticulate.

Derivatio nominis: The name of this species is derived from the name of the Arabian Peninsula, with the suffix -sphodrus, alluding to the group of Carabidae to which it belongs.

***Laemostenus (Arabosphodrus) balkenohli* n. sp.**

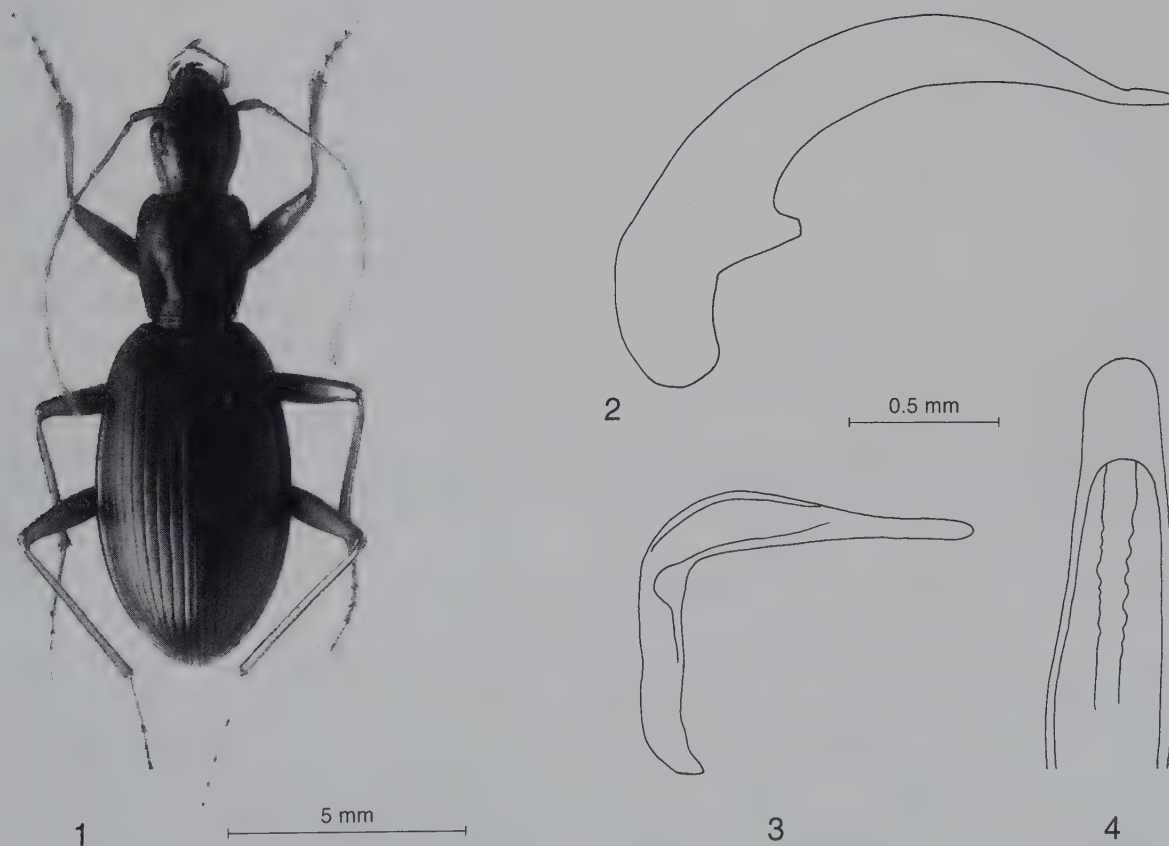
Holotype: ♂, 5.XI.1992. M.D. Gallagher, in coll. Museo Civico di Storia Naturale, Milano. Type locality: Oman, Wakan, Jabal Akhdar, 23°06'N 57°44'E, 1450 m. — **Paratypes:** Oman: 1 ♂, same data as holotype, in coll. Mateu; 1 ♂, 3 ♀♀, Wakan, Jabal Akhdar, 23°08'N 57°44'E, 1460 m, under stones in cultivation, 7.XII.1995, M.D. Gallagher, ONHM, coll. Balkenohl, coll. Sciaky.

Diagnosis: A *Laemostenus (Arabosphodrus)* of 11.9-12.2 mm, microphthalmous, narrow, elongate and convex, with dolioliform pronotum and elytra very weakly striate.

Derivatio nominis: This species is cordially dedicated to Michael Balkenohl.

Description: Length 11.9-12.2 mm; medium-sized species with narrow, elongate, convex body. Habitus as in Fig. 1. Reddish-brown, microsculpture strong on head, pronotum and elytra.

Head big, smooth, very little narrower than pronotum. Mandibles short; eyes small, convex, tempora very long, rectilinear; frontal sulci small, superficial, more or less oval. Both supraocular pore-punctures present.



Figs 1-4: *Laemostenus (Arabosphodrus n. subg.) balkenohli* n. sp., holotype ♂: 1, habitus; 2, aedeagus in lateral view; 3, right paramere; 4, aedeagus in dorsal view.

Pronotum dolioliform, narrow, elongate (ratio of width to length 0.87). Sides not sinuate before hind angles, but linearly constricted, anterior seta at anterior one-fourth, posterior one almost in the hind angle. Fore angles very weakly prominent, rounded, hind angles obtuse, lateral gutter very narrow. Basal foveae impunctate, very long, reaching the middle of the length. Mesosternum not denticulate in front of mesocoxae.

Elytra elongate oval, convex, strongly constricted at base. Basal margin meeting the lateral margin with an acute angle; humeral tooth small, hardly distinct, basal margin almost straight, basal pore-puncture absent. Striae very weak, weakly punctate; intervals flat.

Legs very long and slender; tarsi narrow, not wrinkled dorsally and sparsely pubescent, male fore tarsi quite strongly dilated; meso- and metatibiae straight, with no additional hairs; claws smooth. Metatibial pubescence reduced to a few apical setae.

Genitalia: Aedeagus relatively small, long, with apex simple, rounded in dorsal view (Figs 2 and 4). Right paramere long, gradually attenuated towards apex (Fig. 3), left one rounded, without membranous prolongation at tip.

DISCUSSION

Zoogeography

This is the second Sphodrini endemic to the Arabian Peninsula. The first one, *Sphodrus trochanteribus* Mateu, 1990, has been found in North Yemen. It is interesting to note here that the whole of the Carabid fauna from Yemen seems to show Ethiopian affinities. A new subgenus of *Trechus* described by MATEU (1990) also seems related to the species from the high mountains of East Africa. On the other hand, no indigenous *Laemostenus* are known from the Ethiopian region, therefore the species described here obviously derives from Palearctic lineages.

This subgenus represents the first group of Sphodrini endemic to the Arabian Peninsula. There are two ways by which this group could have reached its present distribution: either from the eastern Mediterranean area through the Arabian Peninsula, or from southern Iran through the Strait of Hormuz. The mountains of Oman are geologically the extreme end of the Zagros chain that crosses Iran from north-west to south-east. On the other hand, the mountains of Yemen at the southern tip of the Arabian Peninsula are geologically related to the East African mountains.

The climate of the Arabian Peninsula has not always been the same as it is today. Before the Würm Ice Age, 20,000 years ago, there was a period of very heavy rain in that area that made it become densely vegetated. Later, during the Würm Age (8,000 years ago), the climate became drier and the sea was 120 metres lower than its present level, transforming the Arabian Gulf into a series of small salty lakes while the Strait of Hormuz was completely emergent and allowed passage of fauna from one to the other side. This confirms that a passage from the north was possible as well as a passage from the west (DUMONT 1991).

Relationships

The general aspect of *Laemostenus balkenohli* n. sp. is similar to that of *Antisphodrus* Schaufuss, 1865 (a subgenus widely distributed from Morocco to Iran), but it lacks all apomorphies that normally characterise the latter subgenus (additional setae on head and pronotum, mesosternum denticulate in front of mesocoxae, brush of setae on male mesotibiae, etc.). In fact, there are representatives of the subgenus *Antisphodrus* both in Turkey and in Iran, but all of them seem very different from the new species described here.

The sum of the characters could point towards a relationship with *Laemostenus* s. str., in particular with a species from Egypt, *L. aegyptiacus* Schatzmayr, 1936. This species is the most adapted to desert areas. It has been found in two localities that are more than 300 km from each other. The type locality of *L. aegyptiacus* is Wadi Garraui, near Heluan, about 30 km south of Cairo, while the second specimen was found in El Netifim, in southern Sinai. A thorough examination of both specimens revealed no remarkable differences. I have noted a certain similarity in general appearance with *L. balkenohli*, although some characters prevent, in my opinion, the inclusion of *L. balkenohli* to *Laemostenus* s. str. First of all, the true *Laemostenus* consistently have some denticulations on the claws, reduced in some species, but always visible; furthermore, the aedeagal shape is markedly different, with an apical lamella very short in *Laemostenus* and quite long in *Arabosphodrus*. Unfortunately the aedeagus is still unknown in *L. aegyptiacus* and therefore I cannot tell whether this species approaches *L. balkenohli* in this character too. The only species of *Laemostenus* s. str. showing an aedeagus similar to that of *L. balkenohli* is *L. luristanus* Casale, 1988, from Iran, but this species is not depigmented, has the claws distinctly denticulate and is very different in many other characters from the species here described.

In habitus, *Arabosphodrus* is also similar to *Stenosphodrus* (a subgenus endemic to Central Asia), but the shape of the basal margin of elytra differentiates the two; besides that, the shape and size of the aedeagus are also different. Following the key to the subgenera proposed by CASALE (1988) and trying to determine the new species one would classify it as a *Stenosphodrus*. Actually many characters are very similar in both subgenera, even though examination of two undescribed species of *Stenosphodrus* allowed me to note that several characters considered as diagnostic of this subgenus are really only specific of *L. (S.) leptoderus* Reitter, 1892, type species and only species described up to day. For instance, the pronotum is described as dolioliform in *Stenosphodrus*, but in the two species I know it is cordiform, the mesonotum is described as not denticulate in front of the mesocoxae, but in the two species it is distinctly denticulate, and so on. *L. balkenohli* shares many characters with *L. leptoderus*, but the two type localities are so far from each other that a real relationship is difficult to propose. More probably it is a convergence of certain characters that has lead to the observable similarity.

Apparently *Arabosphodrus* occupies an intermediate position between *Laemostenus* and *Stenosphodrus*. At the moment it is difficult to state which of the two subgenera is its nearest relative and only the discovery of more species of either of the two could throw light on this point. If a relationship with *Laemostenus* was proved, it could be witness to an ancient population from Oman that arrived from the west across the Arabian Peninsula, while on the other hand the population could have arrived from the north, from Central Asia across the Strait of Hormuz in a period when it was closed and allowed terrestrial animals to pass in both directions.

ACKNOWLEDGEMENTS

I wish to express here my warmest thanks to Dr. M. Balkenohl (Denzlingen, Germany), who has kindly forwarded to me this exceptionally interesting new species (made available by courtesy of the Director of the Oman Natural History Museum, Muscat), to Prof. A. Casale (University of Sassari, Institute of Zoology) for always encouraging me, to Mr. A. Sabbadini and Mr. M. Pavesi (Museo Civico di Storia Naturale, Milano), respectively for the photograph and the interesting discussions on the systematic position of the new species and on the biogeography of the Near East, and to all my friends of A.L.S.E. (Associazione Lombarda di Studi Entomologici) for variously helping me during the preparation of this work.

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The Chrysomelidae of Arabia

Lev Medvedev

Abstract: The publication includes a faunistical list of 155 species with descriptions of 12 new species: *Cryptocephalus omanicus*, *C. pubescens*, *Thelyterotarsus denticulatus*, *Th. substriatus* (Cryptocephalinae), *Macrocoma aladina*, *M. budura*, *M. saudica*, *M. daccordii* (Eumolpinae), *Calomicrus buettikeri*, *Monolepta saudica*, *M. arabica* (Galerucinae), *Blepharida arabica* (Alticinae) and one new subspecies: *Colaphus pulchellus arabicus* (Chrysomelidae). New synonyms: *Comptolenes fairmairei* Lefèvre, 1891 = *Antipa filitarsis* Lacordaire, 1848; *Coenobius arabicus* Lopatin, 1979 = *Isnus biseriatus* Chapuis, 1877; *Melixanthus jordanicus* Lopatin, 1979 = *M. granularis* Suffrian, 1857; *Cryptocephalus elkhaldii* Lopatin, 1983 = *C. senegalensis* Suffrian, 1857; *C. arabs* Suffrian, 1854 and *C. fulgurans* Fairmaire, 1873 = *C. petraeus* Suffrian, 1857; *Pseudocolaspis millingeni* Pic, 1898 = *Macrocoma lepieuri* Lefèvre, 1876; *Iranomolpus badius* Lopatin, 1979 and *Andosiomorpha argentata* Lopatin, 1981 = *Eryxia grandis* Lefèvre, 1890; *Crosita brancuccii* Daccordi, 1982 = *C. grata brancuccii* Daccordi. Genera *Iranomolpus* Lopatin, 1979 and *Andosiomorpha* Lopatin, 1981 are new synonyms of the genus *Eryxia* Lefèvre, 1890. A key for Arabian Chrysomelidae is proposed as well as a full catalogue of Arabian Chrysomelidae.

خنفسيات الأوراق من الجزيرة العربية

ليف مدفديف

خلاصة: يتضمن البحث قائمة لـ ١٥٥ نوع مع وصف لـ ١٢ نوع جديد للعلم: *C. «Cryptocephalus omanicus»*, *M. budura*, *Macrocoma aladina*, *Th. substriatus* (Cryptocephalinae), *Thelyterotarsus denticulatus*, *pubescens* (Galerucinae), *M. arabica*, *Monolepta saudica*, *Calomicrus buettikeri*, *M. daccordii*, *M. saudica* (Eumolpinae), *Blepharida arabica* (Alticinae)، وتحت نوع واحد جديد *Colaphus pulchellus arabicus* (Chrysomelidae). كما تضمن البحث المرادفات الجديدة.

أما الأجناس: *Iranomolpus* Lopatin, 1979 و *Andosiomorpha* Lopatin, 1981 فهي مرادفات جديدة للجنس *Eryxia* Lefèvre, 1890. كما تم اقتراح مفتاح تصنيفي لخنفسيات الأوراق العربية بالإضافة إلى سجل كامل لهذه العائلة في الجزيرة العربية.

INTRODUCTION

The Arabian Peninsula was very poorly investigated with respect to its insect fauna at least until the middle of this century. Up till then not more than a dozen species of Chrysomelidae had been described, mostly without their precise source. The first regional list of leaf beetles was published by BRYANT (1957) based on material from the Natural History Museum, London, mostly collected by H. Scott and E. Britton in 1937-1938. That list included 58 species from North and South

Yemen (Yemen; Aden Protectorate) and others from the western coast of Saudi Arabia. Later, the results of G. Scortecci's expedition in Yemen were published (DACCORDI 1983; SCHERER 1978, 1985). The most abundant Arabian material has been collected during the many year-long expeditions to Saudi Arabia and Oman under the leadership of Prof. W. Büttiker and published, in part, in the "Fauna of Saudi Arabia" series (DACCORDI 1979; DOGUET 1979, 1984; LOPATIN 1979, 1982, 1983; MEDVEDEV 1979, 1962). Besides this, some more rather scanty data appeared in applied entomological publications dealing with agricultural investigations (SHALABY 1961, 1962), which were later united by BECCARI (1971). However, many of the determinations given in these papers are doubtful or definitely incorrect. For example, in SHALABY's (1962) article, the generic names of two species have been confused, this error was then repeated by BECCARI (1971); consequently two non-existent species have been recorded.

The fauna of the Arabian Peninsula includes Palaearctic and Ethiopian elements, but these regions have mostly been studied independently. As a result, some authors studying the Palaearctic fauna, e.g. LOPATIN (loc. cit.) and DOGUET (loc. cit.) have indicated mostly Palaearctic species and even described a few African species as new. On the other hand, African species dominated the publications of BRYANT (loc. cit.) and SCHERER (loc. cit.). In practice this means that one species could be recorded under different names as a result of incorrect identifications or possible synonymies of Mediterranean and African species. The table below shows the dynamics of chrysomelidological research over the last 40 years:

Table 1: Numbers of species per families recorded in different publications.

| Subfamily | BRYANT (1957) | All published data until 1994 | Recorded in this publication |
|------------------|---------------|-------------------------------|------------------------------|
| Alticinae | 22 | 47 | 55 |
| Cassidinae | 1 | 2 | 2 |
| Chlamisinae | - | 1 | 1 |
| Chrysomelinae | 1 | 3 | 5 |
| Clytrinae | 7 | 16 | 16 |
| Criocerinae | 1 | 1 | 2 |
| Cryptocephalinae | 6 | 16 | 25 |
| Eumolpinae | 8 | 20 | 25 |
| Galerucinae | 10 | 11 | 21 |
| Hispinae | 2 | 3 | 3 |
| Total | 58 | 101 | 155 |

The present contribution includes two parts. The first is a key to the Chrysomelidae of the Arabian Peninsula. The second part is a catalogue of the Arabian Chrysomelidae, containing a list of all species currently known to occur, with all the available bibliography referring to the Arabian Peninsula, distributions, synonyms and taxonomic notes. This part also includes both faunistic data based on new material from the Natural History Museum Basel, collected mostly by Prof. W. Büttiker, (in this case the collector's name is omitted) and descriptions of new taxa. All this material, including type specimens, is deposited in the above museum, except duplicate paratypes retained in the author's collection (LM), Institute of Animal Morphology and Ecology, Moscow. As regards localities, the geographical coordinates, habitats, etc., have already been published by BÜTTIKER (1980, 1981, 1983, 1985, 1989).

PART 1

Keys to subfamilies, genera and species of the Chrysomelidae of Arabia

- 1 Head sharply constricted behind eyes, with a distinct neck. Prothorax much narrower than base of elytra, not margined on sides. Mandibles without teeth. Elytra with regular rows of punctures. Upperside bare (subfamily Criocerinae). Claws connected at base. Prothorax constricted 2
- Head not constricted behind eyes. Mandibles with teeth. Prothorax usually margined (except three genera of Eumolpinae). Claws free (very rarely one claw). Prothorax not constricted 3
- 2 Prothorax constricted in the middle. Vertex broader than long, its anterior angle obtuse. Body broader *Lema*
- Prothorax constricted before base. Vertex longer than broad, its anterior angle acute. Body narrow *Oulema*
- 3 Abdominal sternites 1-4 narrowing in the middle. Body cylindrical, more or less obtuse or truncate on both ends. Last abdominal sternite of female with a deep groove. 4
- Abdominal sternites not narrowing in the middle, last sternite of female without deep groove. Body rounded, oval or elongate 16
- 4 Upperside without rough sculpture (tubercles, ridges). Underside without impressions for reception of antennae and legs 5
- Upperside with a very rough and uneven sculpture forming tubercles, ridges and reticulation. Underside with grooves for reception of antennae and legs. Prosternum between coxae broad anteriorly, strongly narrowing caudad. Pygidium exposed, with a longitudinal ridge (subfamily Chlamisinae) *Chlamisus*
- 5 Antennae serrate from the segment 4 or 5. Prosternum very narrow. Pygidium usually covered with elytra. Body more elongate (subfamily Clytrinae) 6
- Antennae filiform. Prosternum broad (subfamily Cryptocephalinae) 11
- 6 Elytra confusedly punctate. Epipleural lobe of elytra small. Pygidium usually covered with elytra 7
- Elytral punctures arranged in more or less regular rows. Pygidium exposed *Aetheomorpha*
- 7 Epipleura pubescent. Tarsi short and broad, with segment 1 less than twice as long as broad. Without distinct sexual dimorphism. Prothorax with hind angles rectangular or obtuse, but quite distinct. Elytra narrow and elongate, rather large. Upperside fulvous with black spots on elytra, underside black *Paraclytra*
- Epipleura bare. Tarsi more narrow or elongate, with segment 1 more than twice as long as broad 8
- 8 With distinct sexual dimorphism: head, mandibles and legs enlarged in male 9
- Without distinct sexual dimorphism: fore legs of male not elongate 10
- 9 Basal margin of elytra sharp and elevated. Tibiae slender, not gradually broadened from base to apex. Head narrower than prothorax *Antipa*
- Basal margin of elytra obtuse, not elevated. All tibiae gradually broadened from base to apex. Hind angles of prothorax broadly rounded, not elevated. Head of male as wide as prothorax *Coptocephala*

- 10 Hind angles of prothorax distinct, obtusely angulate and slightly elevated *Afrophthalma*
- Hind angles of prothorax broadly rounded, not elevated *Smaragdina*
- 11 Scutellum distinct, sometimes rather small 12
- Scutellum invisible from above. Base of prothorax marginate *Stylosomus*
- 12 Scutellum very narrow and long, cuneiform. Prothorax with a triangular and acute median lobe. Body small *Isnus*
- Scutellum triangular. Prothorax with a truncate basal lobe. Body larger 13
- 13 Prothorax closely fitted to base of elytron, with basal margin not bordered, finely denticulate 14
- Prothorax not closely fitted to base of elytron, with basal margin distinctly bordered 15
- 14 Antennae more short and robust, preapical segments more or less broadened, at least twice as broad as long *Melixanthus*
- Antennae slender and long, preapical segments not broadened, more than twice as long as wide *Cryptocephalus*
- 15 Scutellum with an elevated apex. Epipleura of elytra rather broad anteriorly. Eyes feebly convex. Upperside bare *Pachybrachys*
- Scutellum with a flattened apex. Epipleura of elytra very narrow. Eyes convex. Upperside pubescent *Thelyterotarsus*
- 16 Head hypognathous, mandibles always seen from above, directed down or forward and down 17
- Head opisthognathous, mandibles directed down and backward 60
- 17 Antennae widely separated and placed above base of mandibles 18
- Antennae placed on frons between eyes, rather close to each other 32
- 18 Third tarsal segment deeply incised in the middle, almost down to base (subfamily Eumolpinae). Claws bifid or appendiculate. 19
- Third tarsal segment feebly incised apically or elytral epipleura ciliate at inner margin before apex. Upperside bare (subfamily Chrysomelinae). Claws simple 31
- 19 Propleura of prothorax with anterior margin straight or concave 20
- Propleura of prothorax with anterior margin convex 29
- 20 Claws appendiculate. Prothorax margined on sides. Elytra regularly punctate. Upperside bare 21
- Claws bifid 23
- 21 Mid and hind tibiae deeply excavated before apex *Chloropterus politus*
- Hind tibiae not excavated before apex 22
- 22 Femora not dentate. Mid tibiae not excavated before apex *Taphius*
- Femora with a strong acute tooth. Mid tibiae excavated before apex *Phascus*
- 23 Head deeply excavated above eyes *Scelodonta*
- Head not excavated above eyes 24
- 24 Prothorax not margined on sides. Upperside pubescent 25
- Prothorax margined on sides, sometimes only posteriorly 27
- 25 Prosternum between coxae wide, subquadrate. Body robust, elytra at shoulders much broader than prothorax. Mid and hind tibiae without preapical emargination *Macrocoma*
- Prosternum between coxae narrow, elongate. Body small, slender 26
- 26 Mid tibiae excavated before apex *Malegia*
- Mid tibiae not excavated before apex *Pseudomalegia*

- 27 Mid and sometimes hind tibiae excavated before apex. Upperside with adpressed pubescence *Eryxia*
- Mid and hind tibiae not excavated before apex 28
- 28 Second antennal segment elongate, longer than third. Body glabrous, red with black spots or bands on elytra. Prothorax feebly transverse, with straight lateral margins, much narrower than elytra *Euryope*
- Second antennal segment short, more or less strongly rounded. Body metallic, pubescent (in Arabian species) or glabrous. Prothorax strongly transverse, with rounded side margins, almost as wide as elytra *Colasposoma*
- 29 Upperside covered with scales. Body dark metallic *Pachnephorus*
- Upperside bare. Mid and hind tibiae excavated before apex 30
- 30 Claws simple or with a feeble tooth. Anterior femora not toothed or with a small tooth. Frons as wide as eye *Chloropterus*
- Claws bifid. Anterior femora with a large acute tooth. Frons very narrow, not more than half as wide as eye *Microeurydemus*
- 31 Third tarsal segment of hind tarsi deeply emarginate, narrow. Anterior coxal cavities open. Elytra with geminate rows of punctures *Chrysolina*
- Third tarsal segment of all tarsi feebly emarginate, broad. Anterior coxal cavities closed. Elytra confusedly punctate *Colaphus*
- 32 Hind femora not incrassate, without jumping spring inside. Prothorax without basal impressions. Apices of frontal tubercles inclined toward interantennal space (sub-family Galerucinae) 33
- Hind femora moderately or strongly incrassate, with jumping spring inside (sub-family Alticinae) 43
- 33 Antennal insertions situated at level of anterior margins of eyes. Vertex and prothorax deeply punctured. Claws bifid. Anterior coxal cavities closed. Upperside pubescent *Diorhabda*
- Antennal insertions situated behind anterior margin of eyes. Vertex impunctate. Upperside not pubescent, sometimes with very short sparse hairs 34
- 34 Claws bifid. Prothorax with a transverse groove in the middle. Anterior coxal cavities open 35
- Claws appendiculate 38
- 35 Transverse groove of prothorax not interrupted in the middle. Prothorax and scutellum of male simple 36
- Transverse groove of prothorax interrupted in the middle. Male scutellum very narrow and elevated, hind margin of prothorax with a protuberance in the middle, partly covering scutellum *Diacantha*
- 36 Transverse groove of prothorax curved, more deep in the middle. First antennal segment of male broad, flattened, with dense erect hairs. Pygidium of female very long, triangular *Aulacophora*
- Transverse groove of prothorax straight, more deep on sides. Pygidium of female not elongated 37
- 37 Head of male with a deep cavity delimited behind by a ridge. First antennal segment of male broadened, hairy and excavated *Lamprocopa*
- Head of male simple. Antennal segments of male longitudinally carinate *Leptaulaca*
- 38 Prothorax with a transverse groove in the middle, usually interrupted centrally.

| | | |
|----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|
| | Anterior coxal cavities open | 39 |
| – | Prothorax without transverse groove in the middle, uniformly convex or with feeble indistinct impressions | 40 |
| 39 | Anterior border of prothorax not margined. Mid and hind tibiae spined | <i>Asbecesta</i> |
| – | Anterior border of prothorax margined. Hind tibiae not spined | <i>Mimastra</i> |
| 40 | Anterior coxal cavities open. First segment of hind tarsus about as long as remainder combined | 41 |
| – | Anterior coxal cavities closed | 42 |
| 41 | Prothorax distinctly broader than long. Body entirely fulvous | <i>Calomicrus</i> |
| – | Prothorax as broad as long. Elytra with black stripes | <i>Paraluperodes</i> |
| 42 | First segment of hind tarsus as long as or longer than remainder combined. Hind tibiae spined | <i>Monolepta</i> |
| – | First segment of hind tarsus much shorter than remainder combined. Hind tibiae not spined | <i>Dercetina</i> |
| 43 | Antennae with 10 segments. Posterior tarsi placed on dorsal side of tibiae before apex | <i>Psylliodes</i> |
| – | Antennae with 11 segments. Posterior tarsi placed at apices of tibiae | 44 |
| 44 | Prothorax with a longitudinal row of large punctures forming a longitudinal groove on each side of the middle at fore margin. Body large. Claws bifid | <i>Blepharida</i> |
| – | Prothorax without any impressions at anterior margin. Body usually small. Claws with a basal tooth or simple | 45 |
| 45 | Mid and hind tibiae with an obtuse tooth behind the middle, the tooth being continued by an excavation with a marginal row of stiff bristles. Elytra with regular rows of punctures. Anterior coxal cavities closed behind. Body metallic or black | <i>Chaetocnema</i> |
| – | Mid and hind tibiae with neither a tooth nor a preapical excavation | 46 |
| 46 | Prothorax with distinct impressions or grooves before hind margin | 47 |
| – | Prothorax without any distinct impressions | 51 |
| 47 | Prothorax with an antebasal transverse impression | 48 |
| – | Prothorax without antebasal transverse impression, but with a short longitudinal groove on each side of basal margin. Elytral punctures arranged in more or less regular rows. Frontal tubercles absent. Anterior coxal cavities closed behind | <i>Podagricra</i> |
| 48 | Antebasal transverse impression of prothorax extending down to sides of prothorax. Body metallic. Elytra confusedly punctate | <i>Altica</i> |
| – | Antebasal transverse impression of prothorax delimited on sides by a short longitudinal impression | 49 |
| 49 | Upperside pubescent. Elytra with regular rows of punctures. Body usually black. Anterior coxal cavities closed behind | <i>Epithrix</i> |
| – | Upperside bare. Elytra confusedly punctate. Body fulvous. Anterior coxal cavities open behind | 50 |
| 50 | Interantennal space rather broad and elevated. Frontal tubercles rounded, not very strongly delimited. Antennae with intermediate segments not enlarged. Body less than 3 mm in length | <i>Orthocrepis</i> |
| – | Interantennal space narrow. Frontal tubercles large, triangular, distinctly delimited. Antennae with intermediate segments enlarged. Body larger than 4 mm | <i>Phygasia</i> |

- 51 Interantennal space narrow. Body small, feebly convex, elongate. Anterior coxal cavities open 52
- Interantennal space broad and flat. Body large, broadly ovate 59
- 52 Tarsi with segment 3 entire, not emarginate. Hind tibiae with an axial excavation on upperside. Third antennal segment longer than second and equal to fourth. General appearance *Luperomorpha*-like, but body more robust. Hind tibiae thick, hind tarsal segment 1 almost half as long as tibia. Elytra confusedly punctate *Ethiopia*
- Tarsi with segment 3 bilobed. Hind tibiae usually without axial excavation, thin (if excavated, then hind spurs serrate) 53
- 53 Elytra confusedly punctate. Spurs of hind tibiae not serrate 54
- Elytra regularly punctate. Spurs of hind tibiae serrate (Fig. 50). Body very narrow *Yemenaltica*
- 54 Upperside densely pubescent *Hespera*
- Upperside not pubescent, sometimes with sparse erect hairs at apices of elytra 55
- 55 Hind tarsus with segment 1 equal to or exceeding midway of tibia and inserted always on a small callosity at apex of tibia *Longitarsus*
- Hind tarsus with segment 1 shorter and never inserted on a callosity at apex of tibia 56
- 56 Elytra with sparse fine hairs on apices. Prosternum narrow. Antennae with segments 2 and 3 very short, nearly equal in length; segment 4 distinctly longer than segment 3 *Luperomorpha*
- Elytra not pubescent apically. Proportions of antennal segments 2-4 different 57
- 57 Frontal tubercles obsolete. Hind tibia with a spur inserted medially. Body black or dark metallic, elytra often with a fulvous stripe, sometimes very broad *Phyllotreta*
- Frontal tubercles distinct and prominent. Hind tibia with a spur inserted laterally at apex 58
- 58 Epimeres of prothorax with a deep groove near hind angles. Lateral margin of prothorax strongly angulate behind anterior angles. Body metallic *Angulaphthona*
- Epimeres of prothorax without deep groove near hind angles. Lateral margin of prothorax not or feebly angulate *Aphthona*
- 59 Antennae filiform. Elytra regularly punctate *Amphimela*
- Antennae strongly pectinate, especially in male. Elytra confusedly punctate *Polyclada*
- 60 Prothorax and elytra without marginal expansion, usually with spines. Head not covered with prothorax (subfamily Hispinae) 61
- Prothorax and elytra with a broad marginal expansion. Head covered with prothorax (subfamily Cassidinae) 63
- 61 Anterior margin of prothorax with two spines on each side, lateral margins with three spines 62
- Anterior margin of prothorax without spines, lateral margins with 7-8 spines on each side. Tarsi with two claws. Antennae without spines, not enlarged apically. Elytra with long spines and pubescence *Dicladispa*
- 62 Tarsi with two claws. Antennal segment 1 without spine. Antennae distinctly enlarged toward apex. Elytra with long spines, pubescent *Dactylispa*
- Tarsi with one claw. Antennal segment 1 with a spine. Antennae not enlarged apically. Elytra without spines on dorsum, with short spines at lateral and apical margins *Acmenychus*

- 63 Claws with a comb-like structure *Aspidomorpha*
 — Claws without comb-like structure *Cassida*

Subfamily Criocerinae

Genus *Lema*

Black; head (except clypeus and labrum), prothorax and elytra fulvous with feeble metallic green or blue tint; apices of anterior tibiae often more or less strongly fulvous. Length 6.5-8.0 mm *Lema cephalotes*

Genus *Oulema*

Body entirely flavous, nitid. Prothorax with two rows of strong punctures along the middle and with additional punctures in antelateral part. Length of body 3.3-3.7 mm *Oulema infima*

Subfamily Clytrinae

Genus *Paraclytra*

- 1 Elytra usually with humeral and postscutellar spots and a transverse band behind the middle; humeral spot often absent (Fig. 2). Aedeagus more broad, almost straight in lateral view (Fig. 9). Length of body 6.5-8.5 mm *Paraclytra signata sennariensis*
 — Elytra usually only with a transverse band behind the middle (Fig. 1). Prothorax usually red, rarely black (*P. c. ab. melanaria* Medvedev). Aedeagus more narrow, curved in lateral view (Fig. 8). Length of body 7.0-8.5 mm *Paraclytra crocata*

Genus *Antipa*

- 1 Upperside pubescent. 2
 — Upperside bare 3
 2 Anterior femora multidentate or tuberculate on inner surface, apex of anterior tibiae with an acute tooth. Body fulvous red with more pale elytra, bearing a small spot before the middle near suture and two spots behind the middle black. Aedeagus (Fig. 13) with a strongly produced lobe before orifice. Length of body 6.5 mm. Female unknown *Antipa wittmeri*
 — Femora simple, apex of anterior tibiae without tooth. Reddish fulvous, elytra with a transverse band behind the middle and sometimes with humeral and scutellar spots black (Fig. 3); underside may be also black, usually in female. Aedeagus Fig. 11. Length of body 6.0-6.2 mm *Antipa cingulata*
 3 Hind angles of prothorax not elevated 4
 — Hind angles of prothorax elevated. 5
 4 Prothorax without black spots. Body fulvous, elytra with four black spots, underside either usually infusate on sides of breast and abdomen or black (in female). Aedeagus Fig. 10. Length of body 7-10 mm *Antipa arabica*

- Prothorax with five black spots. Underside and legs black with fulvous tibiae. Length 7 mm *Antipa peyerimhoffi*
- 5 Prothorax with two black spots at base. Scutellum and underside, including pygidium, black. Elytra with four black spots (2, 2), but hind ones often connected in a band 6
- Prothorax without black markings. Elytra with four black spots, sometimes partly reduced 7
- 6 Head black with fulvous clypeus and labrum. Male unknown. Length of body 5 mm. Perhaps only a variation of the next species *Antipa* sp.
- Head fulvous with a black band between eyes. Length of body 5.4-5.7 mm *Antipa decemguttata*
- 7 Body larger, 5.7-7.2 mm. First tarsal segment of fore legs of male much longer than second (Fig. 7). Underside usually fulvous or slightly infusate on sides. Head and scutellum fulvous. Aedeagus Fig. 12 *Antipa ogloblini*
- Body smaller, 4.5-5.5 mm. First tarsal segment of male only a little longer than second. Underside usually black with a fulvous pygidium. Head usually with a black stripe between eyes, scutellum black *Antipa filitarsis*

Genus *Coptocephala*

Head, underside and legs black, upperside fulvous, elytra with an elongate humeral spot and two spots behind the middle, often connected, greenish black (Fig. 4). Aedeagus with a longitudinal ridge beneath. Length of body 4-5 mm

Coptocephala crassipes iranica

Genus *Afrophthalma*

- 1 Frons wider than maximal length of eye, strongly punctate. Hind angles of prothorax elevated and obtusely angulate. Body fulvous, elytra with a black spot just before apex (Fig. 5), prothorax sometimes infusate, at least on sides. Aedeagus Fig. 14. Length of body 3.9-4.8 mm *Afrophthalma antipaeformis*
- Frons not wider than maximal length of eye, feebly punctate. Hind angles of prothorax not elevated, rectangular. Body entirely fulvous, only apices of antennae more or less infusate. Length of body 3.5-7.0 mm *Afrophthalma filiformis*

Genus *Smaragdina*

- 1 Body elongate. Apices of antennae infusate. Fulvous, elytra with an elongate, blue marginal patch from shoulders down to margins, expanding towards apex. Length of body 5.5 mm *Smaragdina arabica*
- Body robust. Antennae not infusate at apices. Fulvous, elytra with two dark, green, transverse bands (Fig. 6). Aedeagus Fig. 15. Length 5.0-5.8 mm *Smaragdina saudica*

Genus *Aetheomorpha*

Body fulvous, sometimes scutellum, spot behind the middle of elytra and breast black or infusate. Length of body 2.8-3.3 mm *Aetheomorpha seminigra pumilio*

Subfamily **Cryptocephalinae**Genus *Isnus*

Body black, basal segments of antennae fulvous, legs dark brown with more light tibiae and tarsi. Head shagreened, prothorax very densely and strongly punctate. Length of body 1.6-1.8 mm *Isnus biseriatius*

Genus *Melixanthus*

- 1 Broadened antennal segments only a little longer than broad. Upperside densely shagreen, prothorax finely punctate. Body small, oval (subgenus *Melixanthus*) 2
- Broadened antennal segments about twice as long as broad. Upperside shining. Body large, cylindrical, slightly narrowing caudad (subgenus *Anteriscus*) 3
- 2 Upperside fulvous, unicolourous. Head fulvous or black. Length of body 1.6-2.1 mm
Melixanthus (Melixanthus) granularis
- Prothorax dark brown with side margins and two spots at base fulvous; elytra fulvous with humeral spot and sutural stripe dark brown or pitchy. Length of body 1.9-2.6 mm
Melixanthus (Melixanthus) brunnicollis
- 3 Prothorax impunctate, fulvous red with two discal and four basal spots black. Elytra fulvous red; humeral spot, two transverse bands, apex, sutural stripe and lateral stripe starting behind humerus black; sometimes elytra black. Pygidium fulvous with a black apex, legs fulvous. Length of body 4.4-5.2 mm
Melixanthus (Anteriscus) barkeri
- Prothorax finely punctate, with a black patch on each side of base near hind angles. Elytra fulvous with large spot near scutellum and lateral stripe connected with preapical band black. Legs and underside black in male, fulvous in female. Length of body 6 mm
Melixanthus (Anteriscus) brittoni

Genus *Cryptocephalus*

- 1 Elytra with short erect hairs. Head and upperside and legs fulvous. Head and prothorax strongly punctate, elytra with regular rows of punctures 2
- Elytra not pubescent 4
- 2 Elytra without any dark markings. Underside fulvous with a black metathorax. Aedeagus Fig. 17. Length of body 2.8 mm *Cryptocephalus omanicus* n. sp.
- Elytra at least with a dark suture and a humeral spot. 3
- 3 Upperside shining. Sutural dark stripe narrow and exact. Underside black, abdomen margined fulvous. Vertex not black. Aedeagus Fig. 19. Length of body 3-4 mm
Cryptocephalus pubescens n. sp.
- Upperside dull. Elytra with a dark brown broad and poorly delimited sutural stripe, shortened on both ends and with traces of a longitudinal curved stripe starting from humerus (Fig. 28). Vertex black. Length of body 3.8 mm (female)
Cryptocephalus sp.
- 4 Upperside not metallic 5
- Upperside more or less strongly metallic 11
- 5 Body fulvous, elytra with three undulate and interrupted bands consisting of short dark brown stripes; prothorax with a transverse dark brown band forming a ring in

- the middle and a longitudinal stripe from ring to base. Aedeagus Fig. 18. Length of body 4.3-5.0 mm *Cryptocephalus petraeus*
- Body fulvous or red with black markings or black with light markings 6
- 6 Head and upperside black; spot on head, three spots on prothorax and four spots on elytra (near scutellum, behind middle, before apex and at side margin) fulvous. Underside and legs black. Length of body 3 mm *Cryptocephalus mashonanus*
- Upperside fulvous or red with black spots 7
- 7 Prothorax with two large black spots at base, finely punctate. Elytra with four black spots, often united into two black bands (Fig. 27). Underside, pygidium and legs black, bases of femora and tibiae usually reddish. Aedeagus Fig. 21. Length of body 6.2-8.0 mm *Cryptocephalus senegalensis*
- Prothorax either without spots or with two small round spots in the middle. Legs fulvous 8
- 8 Elytra with basal and preapical black bands; basal band deeply incised at hind margin. Underside fulvous with a black breast, pygidium fulvous. Length of body 3.7-5.2 mm *Cryptocephalus bifasciatus*
- Elytra with spots 9
- 9 Elytra with four black spots (2, 2). Underside and pygidium black, apex of pygidium fulvous. Length of body 4.3-4.8 mm *Cryptocephalus anastasei*
- Elytra with humeral spot and 1-2 small spots behind the middle black (Fig. 26) . . . 10
- 10 Pygidium and underside fulvous. Aedeagus Fig. 20. Length of body 3.5-3.6 mm *Cryptocephalus saudiensis*
- Pygidium and underside black. Length of body 3.0-3.5 mm *Cryptocephalus sacchii*
- 11 Body rusty red with greenish blue elytra. Length of body 3.7-5.0 mm *Cryptocephalus dislocatus*
- Body blackish green, frons, longitudinal stripe on each elytron and legs fulvous; sometimes elytra fulvous with humeral spot, sutural stripe at lateral margin fulvous. Aedeagus Fig. 16. Length of body 2.0-2.3 mm *Cryptocephalus buettikeri*

Genus *Pachybrachys*

Upperside dirty fulvous with a black M-shaped spot on prothorax, scutellum and two longitudinal stripes on each elytron (Fig. 29). Head black with labrum, middle of clypeus and small spot behind eye fulvous. Pygidium black with a fulvous apex. Underside black with epimera of mesosternum and sides of last abdominal segment fulvous. Legs fulvous, but femora more or less infusate on upperside or in the middle upperside with deep dark punctures, forming no rows on elytra. Length of body 3.5 mm. Male unknown *Pachybrachys saudicus*

Genus *Thelyterotarsus*

- 1 Lateral margin of prothorax finely denticulate. Basal margin of elytra without tooth. Prothorax bare, elytra with sparse erect hairs (subgenus *Anodontelytrus*). Upperside fulvous 2
- Lateral margin of prothorax entire. Basal margin of elytra with a developed tooth . . 3
- 2 Lateral margin of prothorax denticulate throughout, all denticles equal in size. Elytra with neither distinct ribs nor callosities. Underside black with a flavous apex of

- abdomen. Upperside virtually monochromous, dirty fulvous. Aedeagus Fig. 23. Length of body 2.4 mm *Thelyterotarsus (Anodontelytrus) denticulatus* n. sp.
- Lateral margin of prothorax denticulate behind anterior quarter; denticles enlarged caudad. Elytra with ribs and callosities. Underside flavous, upperside reddish fulvous, variegated with pale flavous on sides and elevated places. Length of body 3.3 mm (not 4, as given in the original description). Male unknown *Thelyterotarsus (Anodontelytrus) buettikeri*
- 3 Upperside shining, finely pubescent; prothorax not more densely pubescent as elytra (subgenus *Anopsilus*). With distinct sexual dimorphism. Male: frons triangular, about as wide posteriorly as antennal segment 1. Upperside fulvous, prothorax pale flavous at side margins and sometimes in the middle, elytra with a dark brown humeral spot and a short band on apical slope, sometimes also with indistinct dark bands (Fig. 30). Female: prothorax fulvous red, elytra black with basal margin, oblique band before the middle, preapical spot and extreme apex fulvous red. Aedeagus Fig. 22. Length of body 3-5 mm *Thelyterotarsus (Anopsilus) arabicus*
- Upperside dull; at least prothorax very densely pubescent (subgenus *Thelyterotarsus*). 4
- 4 Upperside densely covered with adpressed scale-like white and brown pubescence. Pitchy black; labrum clypeus, indistinct bands on elytra and legs to various degrees reddish fulvous (Fig. 33). Elytra confusedly punctate. Aedeagus with a truncate apex (Fig. 25). Length of body 2.5-3.8 mm *Thelyterotarsus (Thelyterotarsus) wittmeri*
- Prothorax with dense and long adpressed pubescence, elytra with very sparse and short erect hairs. Black or pitchy black; labrum, inner margins of eyes, sides of prothorax and knees fulvous or red; elytra of female with 3-4 fulvous bands (Fig. 31), of male fulvous with a strongly reduced dark colour (Fig. 32). Aedeagus Fig. 24. Length of body 2.2-3.0 mm *Thelyterotarsus (Thelyterotarsus) substriatus* n. sp.
- Genus *Stylosomus*
- 1 Body fulvous; apices of antennae, vertex, elytral suture, breast and tarsi more or less black. Prothorax very densely, almost rugosely punctate. Length of body 1.5-2.5 mm *Stylosomus tamaricis*
- Body entirely flavous. Prothorax strongly but not very densely punctate, with elevated callosities among punctures. Length of body 1.8-2.2 mm *Stylosomus niloticus*

Subfamily Chlamisinae

Genus *Chlamisus*

Reddish fulvous to dusty red, prothorax and elytra with small black spots, knees and tarsi black. Upperside reticulate. Pygidium with a central longitudinal ridge. Length of body 3.4-3.8 mm *Chlamisus aegyptiacus*

Subfamily Eumolpinae

Genus *Taphius*

Body fulvous, elytra with marking surrounding the scutellum and apical patch not extending to suture black, same as metasternum; antennae infusate at apices. Head and prothorax impunctate. Length of body 2 mm *Taphius maculatus*

Genus *Phascus*

Body entirely fulvous, a shining underside a little more reddish. Clypeus not separated from a broad frons, eyes small, ocular grooves narrow, sharp. Head and prothorax very finely punctate, interstices of rows on elytra impunctate. Length of body 2.5-3.5 mm

Phascus pallidus

Genus *Scelodonta*

Body aeneous or bronze with upperside of abdomen (under elytra) blue. Upperside with sparse white scales arranged on elytra into a few spots. Prothorax transversely rugose, elytra strongly punctate, with a few ridges partly more or less strongly blue. Length of body 4.3-5.2 mm

Scelodonta vicina

Genus *Macrocoma*

1 Upperside with dense adpressed scales, without any hairs. Body black or bronze with dark brown elytra, labrum, antennae and legs; elytra often with a black triangle in scutellar area. Robust, prothorax very large, elytra strongly narrowing caudad. Anterior margin of clypeus feebly concave. All femora with a very small tooth. Aedeagus with an elongate-triangular apex (Fig. 39). Length of body 4.3-6.0 mm

Macrocoma lefevrei

– Upperside with distinct hairs, sometimes rather short or more or less strongly enlarged 2

2 Body not metallic, dark brown or fuscous. Narrow and elongate, elytra practically not narrowing caudad, with very short hairs arranged in longitudinal rows. Anterior margin of clypeus deeply angularly emarginate. All femora with a small tooth, latter better developed on hind ones. Aedeagus emarginate at apex (Fig. 35). Length of body 4.6-5.6 mm

Macrocoma brunnea

– Body metallic or at least with distinct metallic sheen. Pubescence of upperside more long and distinct 3

3 Elytra without distinct longitudinal rows of short erect hairs, with dense and long adpressed white pubescence. Femora with a tooth, latter usually as long as base of tibia. Anterior margin of clypeus with a shallow angular excavation (angle about 150°). Scutellum subquadrangular with distinct posterolateral angles and an undulate hind margin. Colour metallic bronze or cupreous 4

– Elytra with distinct longitudinal rows of short erect hairs. Upperside of abdomen (under elytra) weakly sclerotised, brown with metallic gloss 5

4 Pubescence of upperside moderately dense. Femoral tooth longer. Aedeagus moderately strongly curved in lateral view, parallel in dorsal view, with a truncate apex (Fig. 41). Length of body 3.5-4.0 mm

Macrocoma sacra

– Pubescence of upperside dense, covering mostly the main surface. Femora with a shorter tooth. Aedeagus strongly curved in lateral view, attenuating toward apex and with an apical emargination (Fig. 34). Length of body 2.8-3.7 mm

Macrocoma aladina n. sp.

5 Interstices of hairy rows on elytra with adpressed pubescence 6

– Interstices of hairy rows on elytra bare, without adpressed hairs. Anterior and mid femora each with a minute, often indistinct tooth, hind femora with a small tooth. 7

6 Anterior margin of clypeus feebly concave. Upperside bronze or aeneous, with erect hairs yellow, short and thick; adpressed hairs white, a little longer and thinner than

- erect hairs, rather sparse. Scutellum trapeziform with a truncate apex. Antennal segments dark fulvous, segments 8-10 usually more dark. Femora with a thin acute tooth, latter almost as long as base of tibia. Aedeagus with a triangular apex (Fig. 36). Body smaller, length 4.2-4.7 mm *Macrocoma budura* n. sp.
- Anterior margin of clypeus angularly and deeply emarginate. Upperside green with white hairs; erect hairs thin and long, adpressed hairs thin, as long as erect ones, dense. Scutellum hemispherical. Antennal segments 7-11 black. Femora with a very minute tooth. Aedeagus with an apical emargination (Fig. 42). Body larger, length 4.8-5.2 mm *Macrocoma saudica* n. sp.
- 7 Body more robust, elytra narrowing caudad. Hind tibiae angularly broadened at apex (Fig. 45). Rows of hairs on elytra very exact and straight; hairs more broad. Body bronze or greenish aeneous; labrum, antennae and legs dark red or piceous; sometimes elytra brown with strong metallic gloss 8
- Body more slender, elytra practically parallel. Hind tibiae not or very feebly broadened at apex (Fig. 44). Rows of hairs on elytra not quite regular, duplicate; hairs very thin. Upperside usually bicolourous: head and prothorax dark aeneous, elytra brown with metallic gloss; labrum, antennae, anterior margin of prothorax and legs brown. Aedeagus (Fig. 37) with a broadly rounded apex. Length of body 3.4-4.1 mm *Macrocoma buettikeriana*
- 8 Anterior margin of clypeus almost straight. Frons angularly broadened on sides and covering the base of antennae. Aedeagus (Fig. 38) with a rounded apex. Length of body 4.8 mm *Macrocoma daccordii* n. sp.
- Anterior margin of clypeus arcuate. Frons neither angularly broadened on sides nor covering the base of antennae. Aedeagus (Fig. 40) with a rounded triangular apex, pointed at a small tip. Length of body 3.2-4.5 mm *Macrocoma leprieuri*

Genus *Malegia*

Dark bronze; labrum, basal segments of antennae, femora and tibiae fulvous or reddish fulvous; antennal segments 4-11 and tarsi black. All body covered with dense white pubescence. Aedeagus with an acute apex. Length of body 2.3-3.0 mm

Malegia arabica

Genus *Pseudomalegia*

Dark brown with feeble bronze tint, antennae (slightly infuscate toward apices), labrum, clypeus and legs fulvous. Pubescence of upperside yellowish. Length of body 3.2-3.5 mm

Pseudomalegia donckieri

Genus *Eryxia*

Dark or pitchy brown with metallic bronze gloss; upperside with white pubescence.

- 1 Head not very densely pubescent, more sparse on clypeus. Prothorax with maximum width in middle, not compressed anteriorly. Legs dark, unicolourous. Length of body 5.0-8.0 mm *Eryxia grandis*
- Frons and vertex densely pubescent, clypeus smooth. Prothorax with maximum width distinctly behind middle, compressed anteriorly. Legs red fulvous with black apices of femora. Length of body 4.0 mm *Eryxia gracilipes*

Genus *Euryope*

Body red, antennae, mandibles and legs black, elytra with small spot at base near humerus, another small spot at lateral margin behind humerus, transverse band before the middle shortened on both ends, and large spot before apex black or bluish black. Upperside moderately strongly punctate. Length of body 8-12 mm

Euryope rubra

Genus *Colasposoma*

Metallic green, aeneous or bronze, antennae and legs dark fulvous, upperside with dense white pubescence, densely punctate, more coarsely so on elytra. Length of body 5.7-6.4 mm

Colasposoma densatum

Genus *Pachnephorus*

Body narrow and elongate, bronze, covered with moderately dense, white and fulvous scales arranged on elytra into more or less irregular transverse bands. Labrum and antennae reddish fulvous, legs piceous with metallic tint. Prothorax with dense but not very large punctures; interstices of elytral rows impunctate. Length 3.4-3.8 mm

Pachnephorus conspersus

Genus *Chloropterus*

- 1 Body fulvous or reddish fulvous. Claws with an extremely small, almost indistinct tooth. Clypeus and frons strongly punctate. Prothorax finely pubescent. Upperside either spotless or prothorax with four pitchy spots in a transverse row, elytra with a pitchy spot just behind the middle. Length of body 4.3-4.6 mm

Chloropterus lefevrei

- Body fulvous or reddish fulvous. Claws with a distinct acute tooth. Clypeus strongly punctate, frons smooth or indistinctly punctate. Prothorax bare. Upperside without dark spots. Length of body 3.3-4.0 mm

Chloropterus politus

Genus *Microeurydemus*

A poorly-known African genus requiring a complete revision. The species seem to vary in colour, with a more or less identical structure of the aedeagus. Hence, we are not quite sure about the determination of the species mentioned below.

- 1 Upperside dark brown or pitchy brown with feeble bronze or blue gloss, elytra a little lighter, either sometimes fulvous on shoulders and apex or dark fulvous with a darker suture and an irregular longitudinal stripe. Frons more narrow, about 1/15 as wide as head in male and 1/8-1/9 in female. Prothorax more densely punctate on sides than in the middle. Aedeagus without distinct ridge on underside, with a feeble apex. Length of body 3.7-4.7 mm

Microeurydemus ?africanus

- A different combination of characters. Upperside usually fulvous
- 2 Body fulvous, prothorax usually more dark, especially so in the middle, elytra sometimes with a dark suture and an irregular stripe starting from humerus. Frons more broad, about 1/9 as wide as head in male and 1/5-1/6 in female, with a longitudinal groove in female. Prothorax more finely and sparsely punctured on

sides, especially near fore angles, than in the middle. Aedeagus with a longitudinal ridge on underside, with a well-developed apex. Body larger: 5.0-5.5 mm

Microeurydemus flavescens

- With all characters of *M. flavescens*, except for a more narrow frons (1/15 as wide as head) and a smaller size: 3.3-4.5 mm *Microeurydemus semivittatus*

Subfamily Chrysomelinae

Genus *Crosita* (*Bittotaenia*)

- 1 Body dark blue, elytra dark red with feeble metallic gloss. Interstices of elytral rows very finely punctate. Length of body 8-10 mm *Crosita* (*Bittotaenia*) *aeneipennis*
- Upperside one colour 2
- 2 Body greenish blue, upperside moderately strongly shining, prothorax sparsely and finely punctate, interstices of elytral rows with dense and strong punctures. Length of body 8.3 mm *Crosita* (*Bittotaenia*) *grata brancuccii*
- Body black with very feeble metallic gloss. Interstices of elytral rows with strong but rather sparse punctures. Aedeagus Fig. 43. Length of body 8.5-11.0 mm *Crosita* (*Bittotaenia*) *turanica*

Genus *Colaphus*

Bronze; basal segments of antennae, extreme apices of elytra, tibiae and tarsi reddish fulvous. Upperside strongly punctate. Length of body 4.6-4.9 mm

Colaphus pulchellus arabicus n. ssp.

Subfamily Galerucinae

Genus *Diorhabda*

Fulvous or dirty fulvous with dark antennae and tarsi, elytra usually with more or less distinct longitudinal dark brown stripes. Each elytron with two sharp ridges and usually with 1-2 additional feeble ridges (one along suture, the other between main ridges). Length of body 4.5-6.0 mm *Diorhabda octocostata*

Genus *Aulacophora*

Body fulvous with metasternum and abdomen except last segment black. Male with a very deep groove on prothorax and with antennal segment 1 incrassate and flattened. Length of body 5.0-7.5 mm *Aulacophora foveicollis*

The population from Oman is typical in colouration, but the ones from Saudi Arabia (Fayfa, Jizan) display a fulvous underside, and only the sides of the abdomen are margined black.

Genus *Lamprocopa*

Body fulvous or red fulvous, elytra more light, underside except last segment black. Third antennal segment much longer than fourth. Length of body 5-6 mm. Females strongly resembling *Aulacophora foveicollis* *Lamprocopa delata*

Genus *Leptaulaca*

Head, antennae, prothorax and elytra fulvous; labrum, spot on vertex, three spots on prothorax, two bands on elytra (before and behind the middle) black. Underside black with middle of thorax and last abdominal segment fulvous, legs black with fulvous knees. Upperside practically impunctate. Length of body 6.5-7.3 mm

Leptaulaca fissicollis

Genus *Diacantha*

Fulvous; breast, spot on each side of abdominal sternites 2-4 and two spots on pygidium black. Prothorax impunctate, elytra densely punctate, with a few longitudinal elevated lines. Length of body 6 mm. Male unknown

Diacantha sp.

Genus *Asbecesta*

1 Elytra metallic blue, strongly punctate. Body fulvous with infusate apices of antennae and tarsi. Length of body 5.8-6.2 mm

Asbecesta cyanipennis

– Elytra fulvous with transverse spots before middle and near apex bluish black, finely punctate. Body reddish fulvous with black metepisterna. Length of body 5-7 mm

Asbecesta senegalensis

Genus *Mimastra*

Body narrow, elongate, pale flavous; antennae (except segment 1), tarsi and upperside of femora and tibiae black or at least infusate. Length of body 6.5-10.0

Mimastra gracilis

Genus *Calomicrus*

Body fulvous or flavous.

1 Male with modified mid tibiae and protuberances on abdominal segments (subgenus *Nymphius*). Antennal segment 4 in male as long as segments 2 and 3 combined 2

– Male without abdominal processes and modified mid tibiae (subgenus *Calomicrus*). Antennal segment 4 in male about 1.5 times as long as segments 2 and 3 combined. Segment 1 of fore tarsi of male strongly broadened and much shorter than segment 2; same segment of mid tarsi not broadened, elongate. Aedeagus Fig. 51. Length of body 3.0-4.5 mm

Calomicrus (Calomicrus) ophthalmicus

2 Male with long processes on abdominal segments 2 and 3 (Fig. 47), with strongly curved mid tibiae (Fig. 46) and a broadened segment 1 of fore and mid tarsi. Length of body 4.0-4.8 mm

Calomicrus (Nymphius) millingeni

– Male with short and broad processes on abdominal segments 2 and 3 (Fig. 49); mid tibiae curved and strongly broadened just before apex (Fig. 48); segment 1 of fore and mid tarsi broadened. Length of body 3.8 mm

Calomicrus (Nymphius) buettikeri n. sp.

Genus *Luperodes*

Body black, prothorax and elytra flavous, elytra with two black stripes united apically; antennae dark brown with segments 8-10 flavous. Elytra with dense fine punctures. Length of body 3.5 mm

Luperodes quaternus

Genus *Monolepta*

- 1 Elytra black. Body fulvous, antennae dark with fulvous basal segments. Fourth antennal segment in male much longer than first, more than twice as long as segments 2 and 3 combined. Upperside shining, prothorax with impressions, distinctly punctate. Aedeagus Fig. 53. Length of body 4 mm *Monolepta heydeni* 2
- Elytra not black 2
- 2 Elytra fulvous or red with dark bands or spots 3
- Elytra flavous or pale flavous 6
- 3 Elytra tricolourous: each elytron red with two large flavous spots, margined anteriorly and posteriorly with black. Body fulvous. Fourth antennal segment in male longer than first and twice as long as segments 2 and 3 combined. Upperside shining, prothorax finely punctate. Length of body 5-6 mm *Monolepta bioculata*
- Elytra bicolourous 4
- 4 Body red or fulvous red, including antennae and pygidium. Fourth antennal segment in male almost equal to first, about 1.3 times as long as segments 2 and 3 combined. Elytral pattern blue or bluish black, sharply delimited. Upperside shining, very finely punctate 5
- Body pale flavous with a black pygidium. Elytra with narrow angulate band at base, often interrupted, and another one behind the middle pitchy brown, not sharply delimited, sometimes partly or fully reduced. Upperside shining, granulate, prothorax with impressions. Fourth antennal segment in male shorter than first, about 1.2 times as long as segments 2 and 3 combined. Aedeagus Fig. 54. Length of body 3.3-4.0 mm *Monolepta pygidialis*
- 5 Elytra with basal and postmedial bands usually interrupted at suture; hind band sometimes spot-like. Length of body 4.3-4.6 mm *Monolepta lepida*
- Elytra with a patch behind the middle at side margin. Length of body 4 mm. Possibly only a variation of *M. lepida* *Monolepta arvensis*
- 6 Pygidium black. See antithesis 4.
- Pygidium fulvous 7
- 7 Fourth antennal segment in male distinctly longer than first and 2.5 times as long as segments 2 and 3 combined; fourth antennal segment in female about as long as first or segments 2 and 3 combined. Upperside shining, prothorax with impressions, distinctly punctate. Segment 1 of hind tarsus with a black base. 8
- Fourth antennal segment in male shorter than first or segments 2 and 3 combined. Upperside densely microsculptured, head and prothorax very finely punctate, prothorax without depressions. Segment 1 of hind tarsus not black at base. Aedeagus Fig. 52. Length of body 3.2-4.2 mm *Monolepta arabica* n. sp.
- 8 Antennae and tarsi flavous. Aedeagus Fig. 55. Length of body 4.0-4.4 mm *Monolepta saudica* n. sp.
- Antennae (except segment 1) and tarsi black. Length of body 4 mm *Monolepta* sp.

Genus *Dercetina*

Pale flavous; labrum, antennae except bases, tibiae and tarsi black. Length of body 4.5-5.0 mm. Only two immature females are known *Dercetina* sp.

- Elytra without lateral ridge. Length of body 4.7-5.4 mm 2
- 2 Aedeagus Fig. 59 *Altica foveigera*
- Aedeagus Fig. 60 *Altica pyritosa*

Genus *Epithrix*

Black, shining, antennae except apices and legs except hind femora fulvous. Body length 1.4-1.6 mm.

- 1 Aedeagus with parallel sides, including longitudinal groove on underside, in lateral view strongly S-like curved (Fig. 61) *Epithrix dieckmanni*
- Aedeagus with arcuate sides, narrowed in apical quarter and widened again to apex, its groove on underside elongate ovate, very broad; in lateral view aedeagus almost straight (Fig. 62) *Epithrix priesneri*

Genus *Orthocrepis*

Reddish fulvous, including antennae and legs, elytra fulvous with a dark suture. Prothorax indistinctly, elytra moderately densely, punctate. Length of body 2.8-3.5 mm *Orthocrepis ruficollis*

Genus *Phygasia*

Body fulvous.

- 1 Antennal segment 3 distinctly longer than following ones. Epipleura flat. Length of body 4.5-5.0 mm *Phygasia africana*
- Antennal segment 3 subequal to following ones. Epipleura concave. Length of body about 5 mm *Phygasia sulphureipennis*

Genus *Podagric*

- 1 Prothorax without impressions at anterior margin behind eyes 2
- Prothorax with an impression on each side of anterior margin behind eye. Length of body 3-4 mm *Podagric puncticollis*
- 2 Body pale flavous. Aedeagus with a rounded apex (Fig. 64). Length of body 2.9-4.1 mm *Podagric pallidicolor*
- Body fulvous. Aedeagus with a bidentate apex (Fig. 63). Length of body 3-4 mm *Podagric decolorata*

Genus *Ethiopia*

The only known species is *E. tricolor* Scherer, from Ethiopia: fulvous, head and elytra metallic green, underside, tarsi and hind femora dark. A possibly new, yet undescribed species has been found in Yemen (SCHERER 1978).

Genus *Hespera*

Body black, dull, with dense and very short grey pubescence, prothorax and three basal segments of antennae fulvous, legs flavous, with tarsi and apices of hind femora infusate. Elytra finely granulate. Length of body 3 mm *Hespera fulvicollis*

Genus *Longitarsus*

- 1 Upperside dark bronze, antennae and legs fulvous. Length of body 1.8-2.5 mm. A very doubtful encounter in Arabia, perhaps representing in fact *L. fuscoaeneus*
Longitarsus aeneus 2
- Upperside fulvous 2
- 2 Frontal tubercles well developed. Elytral punctures more or less strongly regular. Hind femora with dark apices. Aedeagus Fig. 67. Length of body 1.3-2.0 mm
Longitarsus lycopi 3
- Frontal tubercles indistinct 3
- 3 Elytra with a dark sutural stripe. Body brown with reddish brown head and prothorax and infusate apices of hind femora. Aedeagus Fig. 69. Length of body 2.0-2.9 mm
Longitarsus mirei 4
- Suture not or very narrowly infusate. Apices of hind femora dark 4
- 4 Underside black, head usually dark. Spur of hind tibia longer than width of tibia at apex. Aedeagus Fig. 68. Length of body 1.6-2.4 mm
Longitarsus ballotae 5
- Underside and head fulvous. Spur of hind tibia short 5
- 5 Prothorax with three more or less distinct dark spots. Aedeagus Fig. 65. Length of body 2.0-2.4 mm
Longitarsus arabicus
- Prothorax without dark spots. Aedeagus Fig. 66. Length of body 2.0-2.3 mm
Longitarsus buettikeri

Genus *Luperomorpha*

Body fulvous with infusate apices of antennae, elytra piceous with violet blue tint and sparse erect hairs. Prothorax shining, indistinctly punctate; elytra densely punctate. Aedeagus Fig. 70. Length of body 3 mm
Luperomorpha arabica

Genus *Phyllotreta*

- 1 Anterior part of head perpendicularly deflexed; clypeus triangular, swollen. Body dark green above, black below, anterior part of head, fore legs and hind tibiae flavous. Length of body 3-4 mm. This species as yet unknown to me seems to actually represent the genus *Trachyaphthona*
Phyllotreta flavifrons 2
- Head not deflexed anteriorly, usually uniform dark 2
- 2 Elytra with a fulvous stripe, sometimes very broad or divided into spots 3
- Elytra black or metallic 6
- 3 Elytra dark brown with two fulvous spots. Prothorax dark brown, head pitchy with a fulvous anterior part, antennae fulvous with infusate apical segments. Aedeagus Fig. 71. Length of body 1.5 mm
Phyllotreta buettikeri 4
- Elytra with a fulvous stripe 4
- 4 Fulvous stripe very broad, covering practically all elytra except dark narrow sutural and lateral stripes. Legs fulvous with dark hind femora. Antennae fulvous, infusate at apex 5
- Fulvous stripe not so broad, never covering humerus. All femora except apices black. Antennae black with four basal segments fulvous, segment 5 enlarged in male. Aedeagus Fig. 75. Length of body 1.9-2.2 mm
Phyllotreta variipennis aegyptiaca
- 5 Head and thorax fuscous with slight metallic gloss. Length of body 2 mm
Phyllotreta tenuimarginata

- Head and thorax metallic green. Length of body 1.8-2.4 mm *Phyllotreta latevittata*
- 6 Body black, antennal segments 2-3 and knees dark brown. Frons and vertex distinctly punctate. Length of body 1.9-2.1 mm *Phyllotreta mashonana*
- Upperside metallic. Frons and vertex impunctate except a few punctures near eyes, densely shagreened 7
- 7 Hind tibiae with a long spur, about half as long as tarsal segment 1. Wings absent. Elytra with a feeble humerus, more or less shortened and truncate at apex, rugosely punctate. Antennal segments 2-4 subequal. Upperside dark aeneous green. Aedeagus Fig. 73. Length of body 1.8-2.0 mm *Phyllotreta florieni*
- Hind tibiae with a short spur, about 1/5 as long as tarsal segment 1. Wings developed. Elytra densely but not rugosely punctate 8
- 8 Fourth antennal segment distinctly longer than second or third. Elytra long, narrow, parallel. Upperside not shagreened among punctures, golden green; antennae, tibiae and tarsi either fulvous or apical part of antennae infusate. Aedeagus with an acute apex (Fig. 74). Length of body 1.8-2.3 mm *Phyllotreta peyerimhoffi*
- Fourth antennal segment a little longer than third. Elytra oval. Upperside shagreened among punctures, dark green, antennae black with segments 2 and 3 dark brown, tibiae and tarsi dark brown. Aedeagus with a rounded apex (Fig. 72). Length of body 1.7-2.1 mm *Phyllotreta cheiranthi*

Genus *Aphthona*

- 1 Upperside fulvous 2
- Upperside black with feeble metallic gloss. One or two rare and poorly known species which have been recorded as *Aphthona pygmaea* and *Aphthona* sp. (prope *A. pusilla*)
- 2 Head black or pitchy. Fulvous, apices of antennae and abdomen infusate. Aedeagus Fig. 77. Length of body 1.7-2.0 mm *Aphthona wittmeri*
- Head fulvous, apices of hind femora infusate 3
- 3 Frontal tubercles feeble, poorly delimited behind. Elytra with a dark sutural stripe abbreviated anteriorly. Length of body 2.0-2.5 mm *Aphthona lutescens*
- Frontal tubercles sharp. Elytra without dark sutural stripe 4
- 4 Scutellum black. Length of body 1.8-2.0 mm *Aphthona marshalli*
- Scutellum fulvous. Aedeagus Fig. 76. Length of body 2.3-2.9 mm. Very common in Arabia *Aphthona dubia*

Genus *Angulaphthona*

Metallic blue with black antennae, elongate-oval. Prothorax finely, elytra rather strongly, punctate. Length of body 3.6-4.0 mm *Angulaphthona latipennis*

Genus *Yemenaltica*

Body light reddish fulvous. Head and upperside shagreened, frontal tubercles flat, prothorax with fine sparse punctures, elytral rows feeble, not quite regular. Length of body 2 mm *Yemenaltica scorteccii*

Genus *Amphimela*

Body reddish fulvous, elytra with two large spots at base and behind the middle. Interstices of elytral rows broad, flat, densely punctate. Length of body 5.6 mm

Amphimela sp. (prope *A. bryanti*)

Genus *Polyclada*

Body red, antennae except segment 1, tibiae and tarsi black, elytra black with seven fulvous spots (2, 2, 2, 1), sometimes united into transverse bands. Length of body 10.0-10.5 mm

Polyclada benti

Subfamily Hispinae

Genus *Dactylispa*

Body black, elytra and spines of prothorax sometimes pitchy dark.

- | | | |
|---|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|
| 1 | Antennal segments 2-6 strongly flattened, transverse, with acute apical angles | 2 |
| – | Antennal segments 2-6 cylindrical, not flattened, with a usual obtuse apex; segments 3-5 a little longer than broad. Length of body 2.6-3.0 mm. Very likely to occur in Arabia | <i>Dactylispa dilaticornis</i> |
| 2 | Elytra with lateral spines distinctly longer than dorsal ones. Length of body 3.0-3.4 mm | <i>Dactylispa perpusilla</i> |
| – | Elytra with lateral spines about as long as dorsal ones. Length of body 3.0-3.8 mm | <i>Dactylispa clavata</i> |

Genus *Acmenychus*

Body entirely black. Antennal segment 1 with a long spine. Prothorax with two spines on each side of anterior margin and three spines at lateral margin. Elytra without ribs, with short tubercles on dorsum and more long spines at margins. Length of body 5.5-6.5 mm

Acmenychus planus

Genus *Dicladispa*

- | | | |
|---|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|
| 1 | Prothorax with 7-8 spines on each side. Body dark fulvous, upperside with long yellow pubescence. Elytra with numerous long spines. Length of body 3.8-4.7 mm | <i>Dicladispa pallescens</i> |
| – | Prothorax with 13 long spines on each side. Body fulvous with long yellow pubescence. Male with a spine on antennal segment 1. Widely distributed from Syria to Africa, including Egypt; very likely to occur on the Arabian Peninsula as well | <i>Dicladispa comata</i> |

Subfamily Cassidinae

Genus *Aspidomorpha*

Fulvous to dark brown, expanded parts of prothorax and elytra more pale and transparent, elytra with a pigmented patch on anterior and, usually, posterior angles. Length of body 7-8 mm

Aspidomorpha gruevi

Genus *Cassida*

Body fulvous (live colour may be green), oval, convex, in lateral view with angulation behind scutellum, but without tubercle; anterior angles of elytra acute, protruding, lateral margins declivious, surface very roughly punctate. Claws with an obtuse tooth. Length 4.2 mm

Cassida praetimida

PART 2 SYSTEMATIC ACCOUNT

Subfamily Criocerinae

Lema cephalotes Lacordaire, 1845

Lema cephalotes Lacordaire, 1845. — Mon. Phyt. 1: 328.

Lema cephalotes. — Bryant 1957: 353.

Distribution: North Yemen, Senegal, Guinea, Togo, Dahome, Cameroon, Sudan, Ethiopia.

Oulema infima (Lacordaire, 1845)

Lema infima Lacordaire, 1845. — Mon. Phyt. 1: 337.

Material: Saudi Arabia: 1 ex., Wadi Dhiyan, 1050 m, 13-14.IX.1983.

Distribution: Saudi Arabia, West Africa, Chad.

Remarks: The first record from Arabia.

Subfamily Clytrinae

Parachlytra crocata (Lacordaire, 1848) (Figs 1, 8)

Clytra crocata Lacordaire, 1848. — Mon. Phyt. 8 (2): 226.

Clytra crocata. — Bryant 1957: 353.

Parachlytra crocata. — Medvedev 1979: 295; 1993: 130.

Distribution: Saudi Arabia, North Yemen, South Yemen, Arabia, Palestine.

Parachlytra signata sennariensis (Lacordaire, 1848) (Figs 2, 9)

Clytra signata sennariensis Lacordaire, 1848. — Mon. Phyt. 2: 225.

Clytra rufitarsis. — Bryant 1957: 354.

Parachlytra signata sennariensis. — Medvedev 1979: 295; 1993: 130.

Material: North Yemen: 1 ex., Wadi Zabid, II.1970, A. Szalay-Marzso.

Distribution: Saudi Arabia, North Yemen, South Yemen, Sudan, Ethiopia.

Antipa arabica (Olivier, 1808) (Fig. 10)

Clytra arabica Olivier, 1808. — Entom. 6: 860.

Antipa arabica. — Medvedev 1962: 624; 1979: 295; 1993: 131.

Material: North Yemen: 1 ex., Wadi Zabid, II.1970, A. Szalay-Marzso.

Distribution: Saudi Arabia, North Yemen, Egypt, Palestine.

Antipa cingulata (Lefèvre, 1883) (Figs 3, 11)

Camptolenes cingulata Lefèvre, 1883. — Ann. Soc. ent. France (6) 3: 104.

Antipa pubipennis Medvedev, 1962. — Ent. Review 41 (3): 622.

Antipa cingulata. — Medvedev 1979: 295; 1993: 131.

Distribution: Saudi Arabia, South Yemen.

Antipa decemguttata Walker, 1871

Antipa decemguttata Walker, 1871: — List Col. coll. Lord: 18.

Antipa decemguttata. — Medvedev 1979: 296; 1993: 131.

Material: Oman: 1 ex., Wadi Andam, 650 m, 5.III.1986, M.D. Gallagher; 1 ex., Muscat, Madinat Qaboos, 50 m, 2.IV.1985, C. Holzschuh.

Distribution: North Yemen, South Yemen, Oman, Egypt, Palestine.

Antipa flitarsis Lacordaire, 1848

Antipa flitarsis Lacordaire, 1848. — Mon. Phyt. 2: 160.

Camptolenes fairmairei Lefèvre, 1891. — Ann. Soc. Ent. Belg. 35: 248 (n. syn.).

Antipa flitarsis. — Bryant 1957: 354; Medvedev 1962: 623; 1979: 295; 1993: 135 (key).

Material: North Yemen: 1 ♀, Wadi Zabid, II.1970, A. Szalay-Marzso. — Oman: 3 ♀♀, SE Muscat, Wadi Mayh, 200 m, 11-12.IV.1985, C. Holzschuh.

Distribution: Saudi Arabia, North Yemen, Oman, Egypt, ?Ethiopia (Obock, ex Lefèvre).

Remarks: The type specimens of *A. flitarsis* Lacordaire and *Camptolenes fairmairei* Lefèvre have been restudied.

Antipa ogloblini Medvedev, 1962 (Figs 7, 12)

Antipa ogloblini Medvedev, 1962. — Ent. Review 41 (3): 623.

Antipa ogloblini. — Medvedev 1979: 296; 1993: 131.

Distribution: Saudi Arabia, North Yemen, Oman.

Antipa peyerimhoffi Pic, 1902

Antipa peyerimhoffi Pic, 1902. — Échange 17: 48.

Antipa peyerimhoffi. — Medvedev 1962: 623; 1979: 296; 1993: 135 (key).

Distribution: "Arabia".

Antipa wittmeri Medvedev, 1979 (Fig. 13)

Antipa wittmeri Medvedev, 1979. — Fauna of Saudi Arabia 1: 296.

Antipa wittmeri. — Medvedev 1993: 134 (key).

Distribution: Saudi Arabia.

Antipa sp.

Material: United Arab Emirates: 1 ♀, Kar Nizwa, 3.IV.1991, Gross.

Remarks: This form, a single female, is very possibly only a colour variation of *A. decemguttata* Walker, 1871.

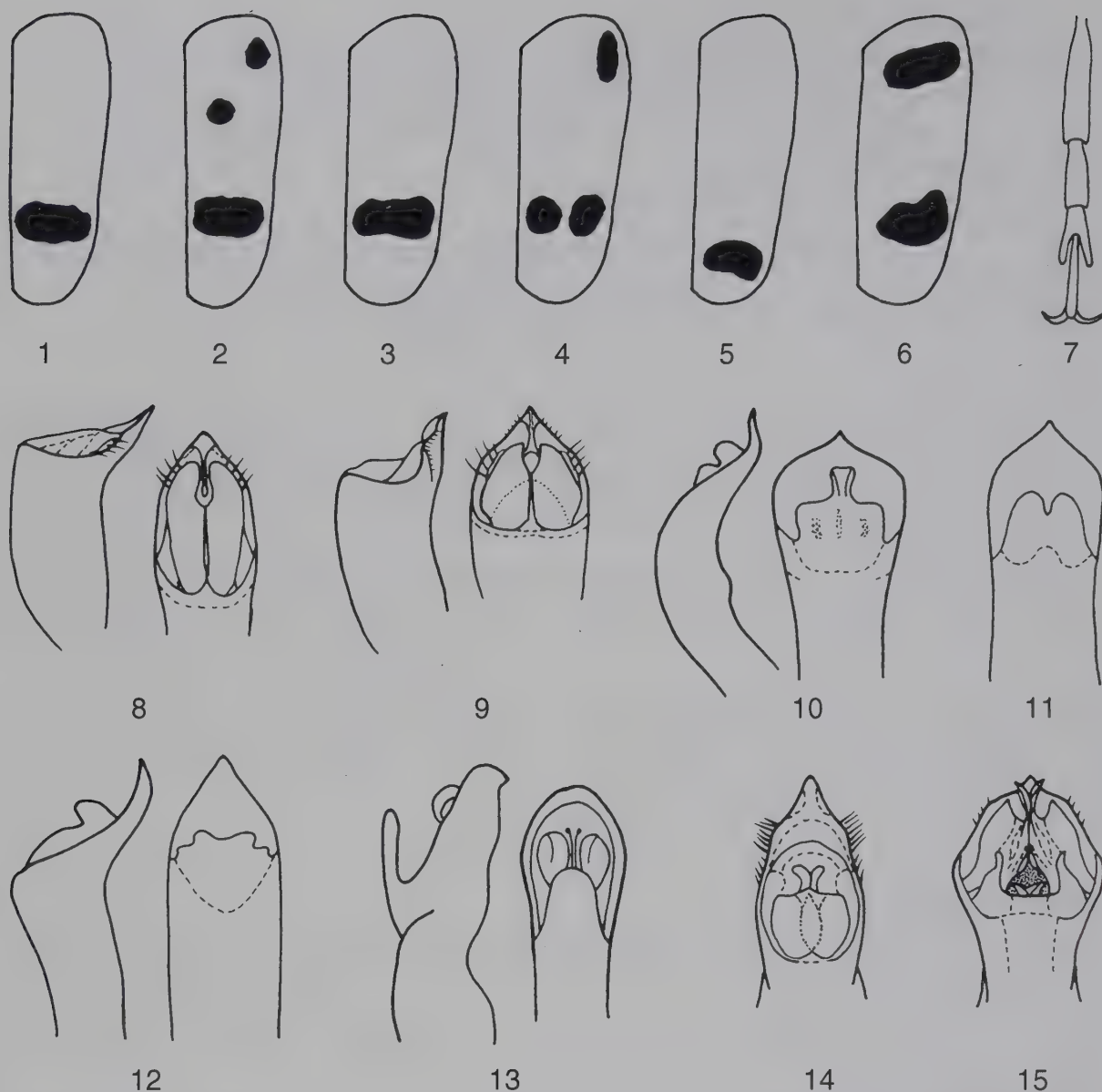
Coptocephala crassipes iranica Medvedev, 1971 (Fig. 4)

Coptocephala crassipes iranica Medvedev, 1971. — Zool. Zhurn. 50 (5): 693.

Coptocephala floralis. — Bryant 1957: 354; Medvedev 1979: 298.

Coptocephala crassipes iranica. — Medvedev 1993: 132.

Distribution: Saudi Arabia, South Yemen, Iran, Afghanistan; a nominative form in Northern Africa.



Figs 1-15: 1-6: Elytral pattern: 1, *Paraclytra crocata*; 2, *P. signata sennariensis*; 3, *Antipa cingulata*; 4, *Coptocephala crassipes iranica*; 5, *Afrophthalma antipaeformis*; 6, *Smaragdina saudica*; 7, fore tarsus of ♂ *Antipa ogloblini*. 8-15: Aedeagus, lateral and dorsal view: 8, *Paraclytra crocata*; 9, *P. signata sennariensis*; 10, *Antipa arabica*; 11, *A. cingulata*; 12, *A. ogloblini*; 13, *A. wittmeri*; 14, *Afrophthalma antipaeformis*; 15, *Smaragdina saudica*.

***Afrophthalma antipaeformis* Medvedev, 1993 (Figs 5, 14)**

Afrophthalma antipaeformis Medvedev, 1993. — Fauna of Saudi Arabia 13: 131.

Distribution: Saudi Arabia.

***Afrophthalma filiformis* (Lacordaire, 1848)**

Miochira filiformis Lacordaire, 1848. — Mon. Phyt. 2: 317.

Material: Saudi Arabia: 1 ♀, dead and strongly damaged, Fayfa, 1240 m, 23.IX.1981.

Distribution: Saudi Arabia, widespread in Africa south of Sahara, including Ethiopia.

Remarks: The first record from Arabia.

Smaragdina arabica* Bryant, 1957Smaragdina arabica* Bryant, 1957. — Ann. Mag. Nat. Hist. 10 (12): 354.*Smaragdina arabica*. — Medvedev 1979: 298; 1993: 135 (key).

Material: Oman: 1 ex., Dhofar, Wadi Darbat, 20.II.1989, W. Wittmer.

Distribution: Saudi Arabia, South Yemen, Oman.

Smaragdina saudica* Medvedev, 1993 (Figs 6, 15)Smaragdina saudica* Medvedev, 1993. — Fauna of Saudi Arabia 13: 132.

Distribution: Saudi Arabia.

Aetheomorpha seminigra pumilio* Lacordaire, 1848Aetheomorpha pumilio* Lacordaire, 1848. — Mon. Phyt. 2: 313.*Aetheomorpha seminigra pumilio*. — Medvedev 1993: 132.

Material: Saudi Arabia: 1 ex., Jizan, 1.III.1984, A.S. Talhouk.

Distribution: Saudi Arabia, North Yemen, Oman, Egypt, Sudan, Ethiopia, Afghanistan.

A nominative form in West Africa.

Subfamily **Cryptocephalinae*****Isnus biseriatus* (Chapuis, 1877)***Coenobius biseriatus* Chapuis, 1877. — Ann. Mus. Civ. Genova 9: 341.*Coenobius arabicus* Lopatin, 1979. — Fauna of Saudi Arabia 1: 302 (n. syn.).

Distribution: Saudi Arabia, Ethiopia.

Melixanthus barkeri* Jacoby, 1901Melixanthus barkeri* Jacoby, 1901. — Trans. Ent. Soc. Lond.: 235.

Material: Saudi Arabia: 2 exs, 20 km SW of Riyadh, 11.X.1988, L. Curtis.

Distribution: Saudi Arabia, South Africa (Natal).

Remarks: The first record from Arabia. One specimen belongs to the typical form, the other has black elytra.

Melixanthus brittoni* Bryant, 1957Melixanthus brittoni* Bryant, 1957. — Ann. Mag. Nat. Hist. 10 (12): 355.

Distribution: South Yemen.

Melixanthus brunnicollis* (Suffrian, 1857) n. comb.Cryptocephalus brunnicollis* Suffrian, 1857. — Linn. Ent. 11: 189.

Material: Oman: 1 ex., Dhofar, Wadi Darbat, 20.II.1989, W. Wittmer; 3 exs, 20 km N of Dhofar, Salalah, 20.II.1989, W. Wittmer.

Distribution: Oman, Egypt.

Remarks: The first record from Arabia. Possibly this species is only a colour variation of *M. granularis* Suffrian, 1857.***Melixanthus granularis* (Suffrian, 1857) n. comb.***Cryptocephalus granularis* Suffrian, 1857. — Linn. Ent. 11: 188.*Melixanthus jordanicus* Lopatin, 1979. — Fauna of Saudi Arabia 1: 301 (n. syn.).*Melixanthus jordanicus*. — Lopatin 1983: 207.

Material: Saudi Arabia: 1 ex., Wadi Dhiyan, 1050 m, 7-8.III.1984; 1 ex., Al Mudig, 500 m, 5.IV.1983; 4 exs, Addar, 150 m, 28.I.1983; 2 exs, Harithi, 1910 m, 10-11.V.1984; 1 ex., Wadi Majarish, 670 m, 29.III.1984; 1 ex., Wadi Nimar, 1600 m, 19-20.V.1983; 4 exs, Wadi Majarish, 1000 m, 23.II.1982. — Oman: 6 exs, Dhofar, 20.II.1989 W. Wittmer.

Distribution: Saudi Arabia, Egypt, Libya, Jordan, Transcaucasus.

Cryptocephalus anastasei Pic, 1924

Cryptocephalus anastasei Pic, 1924. — Échange 39: 30.

Material: Oman: 1 ex., Fanjah, 150 m, 5.IV.1985, C. Holzschuh; 1 ex., Wadi Mayh, 200 m, 11-12.IV.1985, C. Holzschuh.

Distribution: Oman, Egypt.

Remarks: The first record from Arabia.

Cryptocephalus bifasciatus Fabricius, 1781

Cryptocephalus bifasciatus Fabricius, 1781. — Spec. Ins. 1: 145.

Material: Oman: 1 ex., Dhofar, Wadi Dhofar, 20.II.1989, W. Wittmer.

Distribution: Oman, Guinea.

Remarks: The first record from Arabia.

Cryptocephalus buettikeri Lopatin, 1979 (Fig. 16)

Cryptocephalus buettikeri Lopatin, 1979. — Fauna of Saudi Arabia 1: 301.

Cryptocephalus buettikeri. — Lopatin 1983: 205.

Distribution: Saudi Arabia.

Cryptocephalus dislocatus Suffrian, 1857

Cryptocephalus dislocatus Suffrian, 1857. — Linn. Ent. 11: 176.

Cryptocephalus dislocatus. — Bryant 1957: 354.

Distribution: North Yemen, West Africa.

Cryptocephalus mashonanus Jacoby, 1901

Cryptocephalus mashonanus Jacoby, 1901. — Trans. Ent. Soc. Lond.: 234.

Cryptocephalus mashonanus. — Bryant 1957: 354.

Distribution: South Yemen, East Africa.

Cryptocephalus omanicus n. sp. (Fig. 17)

Holotype: ♂, Oman, Tawi Sadh, Wadi Muaydin, 650 m, 22.IV.1988, M.D. Gallagher.

Description: Head very densely punctate, almost granulate, frons more broad. Upperside dull. Prothorax more densely punctate, especially so on sides; interstices mostly more narrow than punctures. Elytra without black margins except basal margin, rows of punctures feeble, not very distinct, among very densely shagreened and punctured interstices. Venter and legs fulvous. Aedeagus with a more short apex and with two round deep grooves on underside before apex, which are sharply limited on outside and behind (Fig. 17). Length of body 2.8 mm.

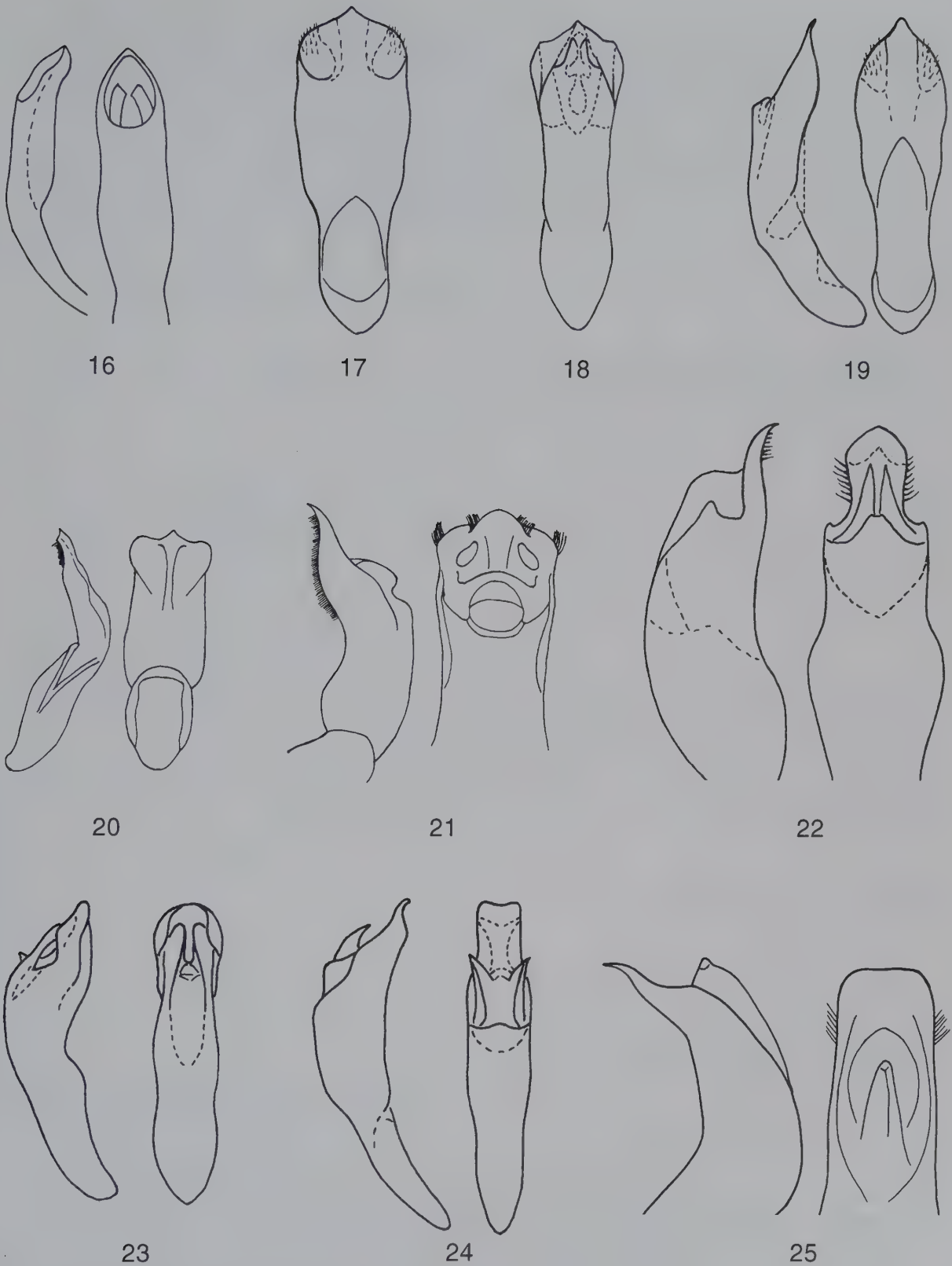
Affinities: Very near to *C. pubescens* n. sp., but differs in a different colouration, details of the sculpture and the shape of the aedeagus.

Distribution: Oman.

Cryptocephalus petraeus Suffrian, 1854 (Fig. 18)

Cryptocephalus petraeus Suffrian, 1854. — Linn. Ent. 9: 77.

Cryptocephalus arabs Suffrian, 1854. — Linn. Ent. 9: 79 (n. syn.).



Figs 16-25: Aedeagus, lateral and dorsal view: 16, *Cryptocephalus buettikeri*; 17, *C. omanicus* n. sp.; 18, *C. petraeus*; 19, *C. pubescens* n. sp.; 20, *C. saudiensis*; 21, *C. senegalensis*; 22, *Thelyterotarsus arabicus*; 23, *Th. denticulatus* n. sp.; 24, *Th. substriatus* n. sp.; 25, *Th. wittmeri*.

Cryptocephalus fulgurans Fairmaire, 1873. — Rev. Mag. Zool. (3) 1: 353 (n. syn.).

Cryptocephalus undulatus. — Bryant 1957: 354.

Material: Saudi Arabia: 1 ex., Wadi Marwani, 7-8.II.1985; 4 exs, Addar, 150 m, 28.I-8.II.1983; 3 exs, Jizan, 15.III.1981; 2 exs, Wadi Andam, 650 m, C. Holzschuh.

Distribution: Saudi Arabia, South Yemen, Africa north of Sahara, including Egypt.

Remarks: A good series of specimens from Arabia is fully identical with *A. petraeus* and *A. arabs*, both described from Aden. *C. arabs* is nothing more than a male of *C. petraeus*. Specimens of *C. fulgurans* Fairmaire, 1873, from Egypt, determined by Priesner, are the same as the Arabian population. *C. sinaita* Suffrian, described from Sinai, might also be proven to be the species in question but it is much larger and I am not sure of its real status. *C. undulatus* Suffrian from Middle Asia and Iran is very like *C. petraeus*, but has different structure to the aedeagus.

***Cryptocephalus pubescens* n. sp. (Fig. 19)**

Holotype: ♂, Oman, Tawi Sadh, Wadi Muaydin, 650 m, 22.IV.1988, M.D. Gallagher. — Paratypes: Oman: 3 ♂♂, same locality and date; 1 ♀, Mudhaybi, 530 m, 12.III.1986, W. Büttiker, LM.

Description: Fulvous; antennae except basal segments, narrow basal margin of prothorax, scutellum and elytra, small humeral spot, narrow sutural stripe and underside except sides of abdomen black. Legs fulvous, more pale on apices of femora, usually with dark spot on innerside of femora; tibiae and tarsi often partly darkened. Body cylindrical. Head strongly punctate. Frons between eyes much broader than upper lobe of eye, especially in female. Antennae thin, reach anterior third of the elytra. Prothorax 1.35 times as broad as long, strongly convex, shining, strongly and densely punctate, with interstices as broad as punctures. Scutellum elongate triangular, notched at base. Elytra 1.2 times as long as broad, moderately shining, with dense erect pubescence and regular rows of punctures, disappearing on apical slope; interstices flat, broad, finely punctate and shagreened. Segment 1 of the fore and mid tarsi of male broadened, but elongate, almost twice as long as broad. Aedeagus (Fig. 19) with two feeble impressions on underside before apex. Length of male 2.9-3.1 mm, of female 4 mm.

Affinities: Very near to *C. vitellinus* Lopatin from Iran, but differs in more broad and strongly punctate frons, as well as impressions on underside of aedeagus.

Distribution: Oman.

***Cryptocephalus sacchii* Jacoby, 1899**

Cryptocephalus sacchii Jacoby, 1899. — Ann. Mus. Civ. Genoa 39: 532.

Cryptocephalus sacchii. — Bryant 1957: 354.

Distribution: North Yemen, Somalia.

***Cryptocephalus saudiensis* Lopatin, 1983 (Figs 20, 26)**

Cryptocephalus saudiensis Lopatin, 1983. — Fauna of Saudi Arabia 5: 205.

Material: Saudi Arabia: 1 ex., Wadi Dhiyan, 1050 m, 13-14.IX.1983; 1 ex., Kushm Dibi, 10.X.1981; 1 ex., Hufuf 15.VIII.1981.

Distribution: Saudi Arabia.

***Cryptocephalus senegalensis* Suffrian, 1857 (Figs 21, 27)**

Cryptocephalus senegalensis Suffrian, 1857. — Linn. Ent. 11: 126.

Cryptocephalus elkhaidii Lopatin, 1983. — Fauna of Saudi Arabia 5: 206 (n. syn.).

Distribution: Saudi Arabia, Egypt, Senegal, Ethiopia.

***Cryptocephalus* sp. (? *C. pubescens* n. sp.) (Fig. 28)**

Material: Oman: 1 ♀, Mudhaybi, 530 m, 16.III.1986.

The single female at my disposal is very near to *C. pubescens* n. sp., but differs in colouration. Head with black vertex. Prothorax fulvous with two pale spots at base, divided by a short pitchy stripe. Elytra with a poorly delimited smoky dark pattern, including a broad sutural stripe starting from humerus (Fig. 28). Abdomen and legs virtually fulvous. Length of body 3.8 mm.

***Pachybrachys saudicus* Lopatin, 1979 (Fig. 29)**

Pachybrachys saudicus Lopatin, 1979. — Fauna of Saudi Arabia 1: 300.

Distribution: Saudi Arabia.

***Thelyterotarsus arabicus* Lopatin, 1982 (Figs 22, 30)**

Thelyterotarsus arabicus Lopatin, 1982. — Fauna of Saudi Arabia 4: 415.

Material: Oman: 4 exs, Dat Hayl, 580 m, 28.XII.1988, M.D. Gallagher; 145 exs, Wadi Mayh, 200 m, 11-12.IV.1985, C. Holzschuh; 23 exs, Madinat Qaboos, 50 m, 2.IV.1985, C. Holzschuh; 1 ex., N of Sama il Qaylah, 400 m, 21.IV.1985, C. Holzschuh; 3 exs, Musandam, 22-23.X.1984, M.D. Gallagher.

Distribution: Oman.

***Thelyterotarsus (Anodontelytrus) buettikeri* Lopatin, 1983**

Thelyterotarsus (Anodontelytrus) buettikeri Lopatin, 1983. — Fauna of Saudi Arabia 5: 207.

Distribution: Saudi Arabia.

***Thelyterotarsus (Anodontelytrus) denticulatus* n. sp. (Fig. 23)**

Holotype: ♂, Saudi Arabia, Al Mudig, 500 m, 5.IV.1983, W. Büttiker.

Description: Dirty fulvous, apices of elytra, a few indistinct spots on prothorax and base of antennae more pale; base of scutellum and underside except last abdominal segment black. Head longitudinally concave anteriorly, frons narrowing to behind, in the narrowest place as broad as eye; strongly and deeply punctate and finely pubescent. Antennae thin, segments 3 and 4 equal, next ones slightly triangularly broadened. Prothorax bare, 1.4 times as broad as long, side margin denticulate, all denticles (about ten) equal in size; surface uneven, rugosely punctate. Scutellum trapeziform with a rounded apex, punctate. Elytra without tooth at basal margin, with fine and sparse erect pubescence and very dense, deep, completely confused punctures, without any callosities and ridges. Segment 1 of all tarsi narrow and elongate, not broadened. Aedeagus Fig. 23. Length of body 2.4 mm.

Affinities: Differs from *Th. caroli* Marseul in lacking callosities on the elytra, from *Th. mirandus* Lopatin, from Iran, in a different colouration and the sparsely pubescent elytra.

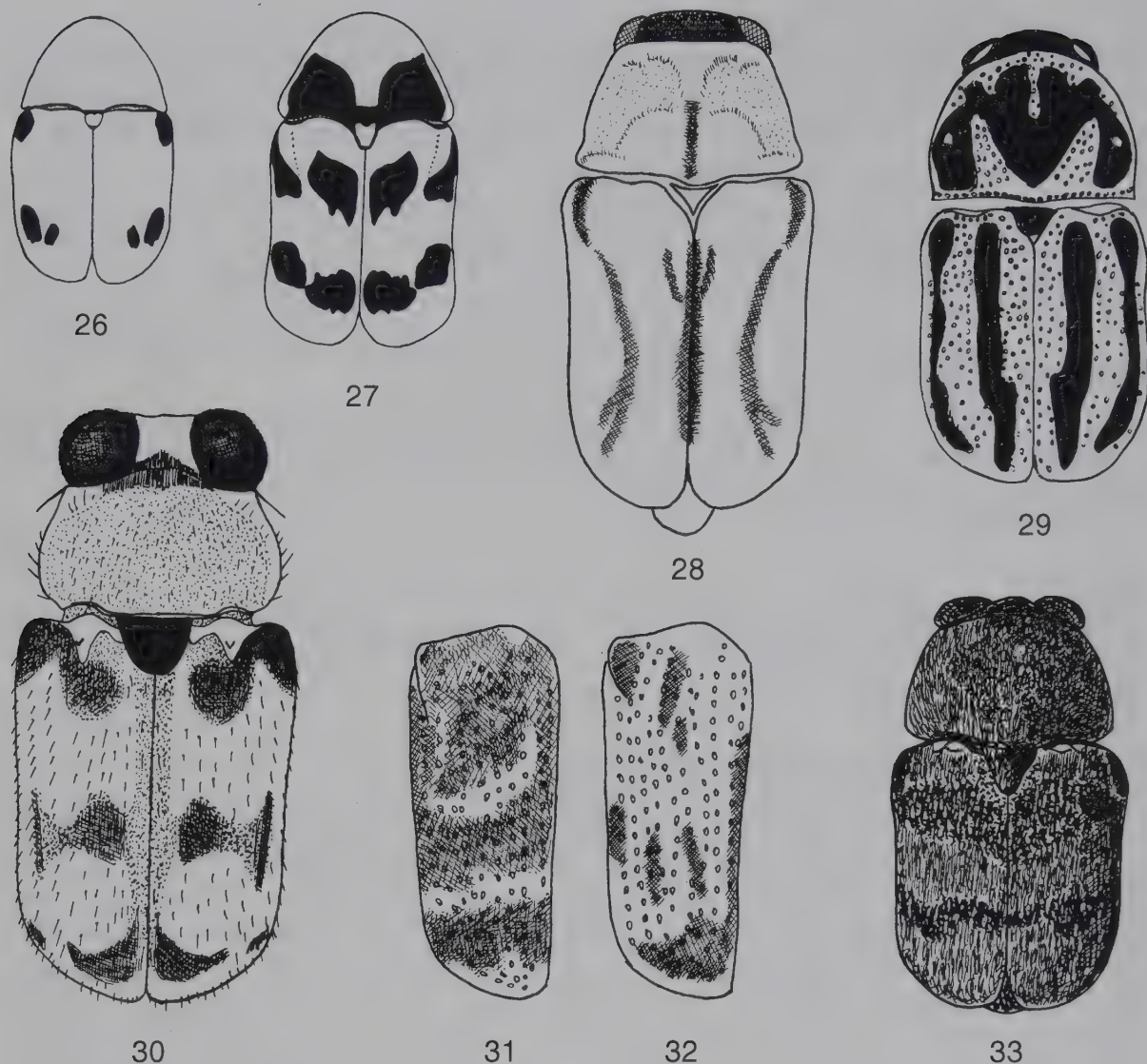
Distribution: Saudi Arabia.

***Thelyterotarsus (Thelyterotarsus) substriatus* n. sp. (Figs 24, 31, 32)**

Holotype: ♂, Oman, N of Sama il Qaylah, 400 m, 2.IV.1985, C. Holzschuh. — Paratypes: Oman: 1 ♂, same locality, LM; 1 ♀, Mu'ammara, 130 m, 25.III.1986, W. Büttiker.

Description: Male: Body black, labrum, base of antennae, sides of prothorax and knees fulvous, two spots on head near eyes red, elytra fulvous with a black humeral spot, preapical band and traces of bands in the middle and near base; punctures also black (Fig. 32). Female: Elytra with three rather broad pitchy black irregular bands (Fig. 31).

Body cylindrical in male, broadened behind in female. Head and prothorax with white, long and adpressed pubescence, elytra with short and sparse semi-erect hairs. Head shining, finely punctate, with transverse callosity between frons and vertex. Frons broad. Antennae reaching



Figs 26-33: General view and elytral pattern: 26, *Cryptocephalus saudiensis*; 27, *C. senegalensis*; 28, *Cryptocephalus* sp.; 29, *Pachybrachys saudicus*; 30, *Thelyterotarsus arabicus*, ♂; 31, *Th. substriatus* n. sp., ♀; 32, same, ♂; 33, *Th. wittmeri*.

humerus, triangularly broadened from the fifth segment, segment 4 a little longer than third. Prothorax shining, with an entire side margin, transversely impressed behind fore margin, 1.5 times as broad as long, distinctly but not densely punctate. Scutellum trapeziform, punctured. Elytra with a tooth at basal margin, 1.2 times as long as broad, with deep punctures confused before middle and forming regular rows with convex interstices behind the middle. Segment 1 of tarsi not broadened in male. Aedeagus Fig. 24. Length of male 2.2, of female 3 mm.

Affinities: Near *Th. wittmeri* Lopatin, 1979, but elytra with regular rows behind middle, aedeagus of another form.

Distribution: Saudi Arabia, Oman.

Thelyterotarsus (Thelyterotarsus) wittmeri Lopatin, 1979 (Figs 25, 33)

Thelyterotarsus (s. str.) *wittmeri* Lopatin, 1979. — Fauna of Saudi Arabia 1: 299.

Thelyterotarsus (s. str.) *wittmeri*. — Lopatin 1983: 207.

Material: Saudi Arabia: 1 ex., Jizan, 1.III.1984.

Distribution: Saudi Arabia.

***Stylosomus niloticus* Suffrian, 1857**

Stylosomus niloticus Suffrian, 1857. — Linn. Ent. 11: 251.

Stylosomus niloticus. — Lopatin 1979: 303.

Distribution: Saudi Arabia, Egypt.

***Stylosomus tamaricis* H.-Schaffer, 1838**

Stylosomus tamaricis H.-Schaffer, 1838. — Fauna Germ.: 143.

Stylosomus tamaricis. — Bryant 1957: 354.

Distribution: North Yemen, South Yemen, South Europe, Caucasus, Central Asia.

Subfamily Chlamisinae

***Chlamisus aegyptiacus* (Desbrochers, 1898)**

Chlamys aegyptiacus Desbrochers, 1898. — Frelon 7: 47.

Chlamisus aegyptiacus. — Daccordi 1979: 304.

Material: Saudi Arabia: 5 exs, Wadi Turabah, 1580 m, 7-20.X.1979; 2 exs, Wadi ad Dilla, 1120 m, 17.X.1979; 1 ex., Ash Sharayi, 23.IX.1978; 1 ex., Harithi, 1910 m, 5.X.1984.

Distribution: Saudi Arabia, Egypt.

Subfamily Eumolpinae

***Taphius maculatus* Bryant, 1957**

Taphius maculatus Bryant, 1957. — Ann. Mag. Nat. Hist. 10 (12): 360.

Distribution: South Yemen.

***Phascus pallidus* Lefèvre, 1884**

Phascus pallidus Lefèvre, 1884. — Bull. Soc. Ent. France (6) 4: 66.

Phascus pallidus. — Daccordi 1979: 304.

Material: Saudi Arabia: 21 exs, Adama, 17.IV.1980; 1 ex., Thanomah, 1950 m, 16.IV.1980; 1 ex., 80 km S of Biljurshi, 2000 m, VIII.1979, Vogel.

Distribution: Saudi Arabia, Ethiopia.

***Scelodonta vicina* Harold, 1877**

Scelodonta vicina Harold, 1877. — Mitt. Münch. Ent. Ver. 1: 106.

Scelodonta vicina. — Bryant 1957: 354; Daccordi 1979: 304.

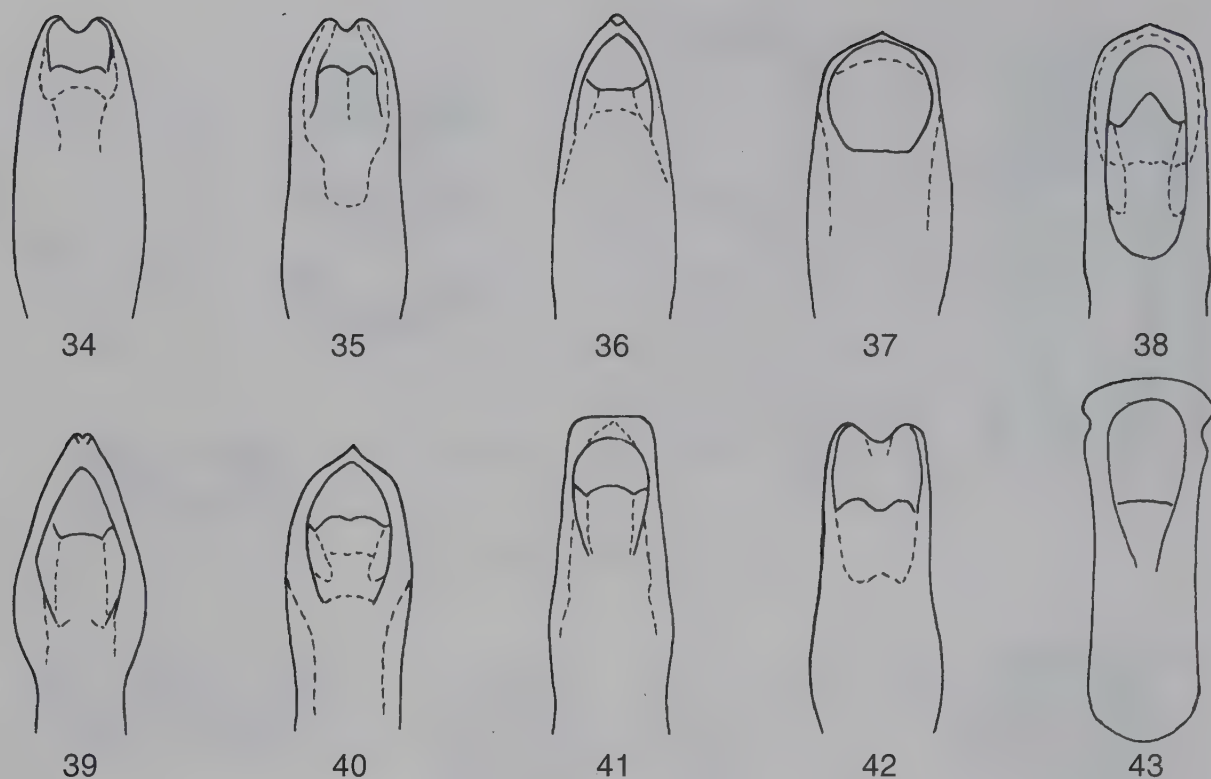
Material: Saudi Arabia: 5 exs, Wadi Uqdah, 11-13.II.1980; 1 ex., Wadi Gaanah, 13-14.II.1980; 1 ex., Wadi Daykah, 600 m, 3.IV.1980; 5 exs, Wadi ad Dilla, 550 m, 17.X.1979. — Oman: 1 ex., Dhofar, X.1979, T. Larsen.

Distribution: Saudi Arabia, North Yemen, Oman, East Africa, north to Ethiopia.

Ecology: In Yemen this species was collected from *Indigofera oblongifolia*.

***Malegia arabica* Daccordi, 1979**

Malegia arabica Daccordi, 1979. — Fauna of Saudi Arabia 1: 306.



Figs 34-43: Aedeagus, dorsal view: 34, *Macrocoma aladina* n. sp.; 35, *M. brunnea*; 36, *M. budura* n. sp.; 37, *M. buettikeriana*; 38, *M. daccordii* n. sp.; 39, *M. lefevrei*; 40, *M. leprieuri*; 41, *M. sacra*; 42, *M. saudica* n. sp.; 43, *Crosita turanica*.

Material: Saudi Arabia: 1 ex., Kushm Dubi, 19.V.1978; 1 ex., Kushm al Buwaybiyat, 26.V.1978; 3 exs, Wadi Shumran, 12-13.II.1980; 1 ex., Wadi Majarish, 7.II.1980; 1 ex., Wadi Karrar, 10.II.1980; 5 exs, Hair SW of Riyadh, 17.IV.1983, C. Holzschuh.

Distribution: Saudi Arabia.

Pseudomalegia donckieri Pic, 1904

Pseudomalegia donckieri Pic, 1904. — Échange 20: 35.

Pseudomalegia donckieri. — Daccordi 1983: 225.

Material: Saudi Arabia: 1 ex., Shuqoya on Red Sea, 2.IV.1983, C. Holzschuh.

Distribution: North Yemen, South Yemen, Saudi Arabia.

Macrocoma aladina Daccordi & Medvedev n. sp. (Fig. 34)

Holotype: ♂, Saudi Arabia, Wadi Daykah, 600 m, 23.IV.1982, W. Büttiker. — Paratypes: Saudi Arabia: 3 exs, same locality; 1 ex., Wadi Uqdah, 11-12.II.1980, W. Büttiker, LM; 2 exs, Wadi Shuqub, 1390 m, 21.IV.1980, W. Büttiker; 1 ex., Thumama Park, 84 km N of Riyadh, 600 m, 6.IV.1985, H. Kessler.

Description: Bronze or aeneous bronze, antennae, labrum and often apices of tibiae dark fulvous. Pubescence silvery white.

Body robust. Head with eyes more narrow than prothorax. Clypeus not impressed with anterior margin arcuately concave. Surface finely and densely punctate, frons not broadened on sides. Antennae practically as in *M. budura* n. sp. Prothorax 1.15 times as wide as long, strongly convex, shining, densely punctate with dense and long adpressed pubescence. Scutellum subquadrate, with distinct hind angles and an undulate apex, densely punctate. Elytra 1.1 times as long as wide and 1.4 times as wide as prothorax, narrowing caudad, widely rounded at apex, with

humeral strongly prominent. Surface finely but very densely punctate and covered with dense adpressed pubescence; erect hairs absent. Femora moderately thick with an acute tooth. Tibiae straight feebly broadened at apex. Tarsi thin. Aedeagus with a bidentate apex (Fig. 34). Length of body 2.8-3.7 mm.

Affinities: Near *M. sacra* Lopatin, 1983, but differs in dense pubescence of upperside and different form of aedeagus.

Distribution: Saudi Arabia.

Remarks: This species was stated as a new one and named by Dr. M. Daccordi (in litt.).

***Macrocoma brunnea* Bryant, 1957 (Fig. 35)**

Macrocoma brunnea Bryant, 1957. — Ann. Mag. Nat. Hist. 10 (12): 359.

Macrocoma brunnea. — Daccordi 1983: 227.

Distribution: North Yemen, South Yemen.

***Macrocoma budura* Daccordi & Medvedev n. sp. (Fig. 36)**

Holotype: ♂, Saudi Arabia, Jizan on Red Sea, 25-26.III.1983, C. Holzschuh. — **Paratypes:** Saudi Arabia: 1 ♀, Shuqoya on Red Sea, 2.IV.1983, C. Holzschuh; 1 ♂, An Nimas, 17.IV.1979, LM.

Description: Bronze; antennae, labrum and legs dark fulvous, incrassate part of femora metallic, pubescence silvery white.

Body robust. Head with eyes as wide as prothorax, shining, very densely punctate, with narrow and partly costate interstices, clypeus not impressed, with anterior margin arcuately concave, frons not broadened on sides, vertex with a narrow smooth central line. Antennae with second segment almost as long as first, curved, segments 3-6 elongate, each of them almost as long as segment 2; next segments broadened, segment 3 elongate-triangular, segments 8-10 short, about as long as wide. Prothorax 1.05 as wide as long, strongly convex, with rounded side margins shining and densely punctate, with moderately dense adpressed pubescence. Scutellum quadrangular, with concave side margins and a truncate apex, punctate. Elytra 1.2 times as long as wide, more or less parallel with a rounded apex, densely punctate, with regular rows of erect hairs, interstices with adpressed hairs. Femora moderately thick with a large acute tooth. Tibiae straight, very feebly broadened at apex. Tarsi narrow, elongate. Aedeagus (Fig. 36) with a narrowly rounded apex. Length of body 4.2-4.7 mm.

Affinities: Resembles *M. leprieuri* Lefèvre, 1876, differs in having interstices of hairy rows on elytra with pubescence and different form of aedeagus.

Distribution: Saudi Arabia.

Remarks: This species was stated as a new one and named by Dr. M. Daccordi (in litt.).

***Macrocoma buettikeriana* Daccordi, 1979 (Figs 37, 44)**

Macrocoma buettikeriana Daccordi, 1979. — Fauna of Saudi Arabia 1: 305.

Material: Saudi Arabia: 1 ex., Jal Khartam, 22.IV.1981; 1 ex., Jabal al Hamariyah, 28.IV.1981. — Oman: 12 exs, Jabal Akhdar Sayq, 2000 m, 21.V.1981, LM.

Distribution: Saudi Arabia, Oman.

***Macrocoma chrysites* (Gerstaecker, 1871)**

Pseudocolaspis chrysites Gerstaecker, 1871. — Arch. Naturg. 37: 39.

Macrocoma chrysites. — Bryant 1957: 354.

Distribution: South Yemen, Tanzania, Mozambique.

Remarks: Determination needs verification. This species is not included in the key.

Macrocoma daccordii n. sp. (Fig. 38)

Holotype: ♂, South Yemen, Hadramaut, Gheyi-Bawa Zir (NW of Mukalla), 2.IV.1988, Liebegott.

Description: Bronze with antennae, labrum and legs dark red, pubescence silvery white. Body comparatively narrow. Head large and long, more broad (with eyes) than prothorax, shining, with dense longitudinal punctures; clypeus triangularly impressed, with an almost straight and wide anterior margin; frons angularly broadened on sides, covering base of antennae; vertex with a smooth tubercle in the middle. Antennae with second segment as long as first, segments 3-6 short, segment 7 more elongate, triangular, segments 8-11 thickened, segments 8-10 a little broader than long. Prothorax 1.15 times as wide as long, with sides slightly rounded, surface feebly convex, densely punctate, with adpressed sparse pubescence. Scutellum pentagonal with concave side margins, punctate. Elytra 1.25 times as long as broad and 1.3 times as broad as prothorax, slightly narrowing caudad and broadly rounded at apex, with humeri strongly prominent; surface densely punctate, grooved just behind scutellum, with regular rows of erect hairs and not pubescent interstices. Femora thin, each with a small acute tooth, tibiae thin and straight, moderately broadened at apex. Tarsi very thin, last segment almost as long as three preceding combined. Aedeagus (Fig. 38) with a rounded apex. Length of body 4.8 mm.

Affinities: Very near to *M. leprieuri* Lefèvre, 1876, differs in other form of clypeus and aedeagus as well as in unusual structure of frons.

Distribution: South Yemen.

Remarks: I dedicate this species to my friend, Dr. M. Daccordi.

Macrocoma lefevrei (Baly, 1878) (Fig. 39)

Pseudocolaspis lefevrei Baly, 1878. — Journ. Linn. Soc. Lond. 14: 260.

Macrocoma lefevrei. — Bryant 1957: 354.

Material: Saudi Arabia: 2 exs, Wadi Majarish, 4.IV.1980. — Oman: 1 ex., Ras Dhabdhub, 180 m, 17.III.1986; 1 ex., Shaqq, 55 m, 10.III.1986.

Distribution: Saudi Arabia, Oman, Iran.

Macrocoma leprieuri (Lefèvre, 1876) (Figs 40, 45)

Pseudocolaspis leprieuri Lefèvre, 1876. — Abeille 14: 6.

Pseudocolaspis millingeni Pic, 1898. — Misc. Ent. 6: 154 (n. syn.).

Macrocoma leprieuri. — Shalaby 1961: 226; Beccari 1971: 252; Daccordi 1979: 305; 1983: 227.

Material: Saudi Arabia: 2 exs, Jabal Ibrahim, 1540 m, 24-26.VIII.1980; 1 ex., Wadi Maraum, 240 m, 3-4.V.1984; 1 ex., Baharah, 9.XII.1980; 1 ex., 84 km N of Riyadh, 600 m, 6.IV.1985, H. Kessler; 2 exs, An Nimas, 18.VIII.1981; 1 ex., N Hijaz, 111 km before Al-Ula, 860 m, 21.IV.1979; 1 ex., 17 km S of Khaybar, 680 m, 26.IV.1979; 1 ex., Jazeed, 2200 m, 29.IX.1981; 4 exs, Asir Mountains, 1100 m, 30 km E of Bisha, 25.IV.1979, H. Amsel; 3 exs, Baharah, 9.XII.1980; 2 exs, Jizan, 1.III.1984, A.S. Talhouk; 2 exs, Fayfa, 23-25.X.1983; 1 ex., Sabya, 13-14.XII.1936, Philby.

Distribution: Saudi Arabia, North Yemen, Algeria.

Remarks: I am not quite sure of the correct determination for this generally abundant Arabian species. Dr. M. Daccordi, who had cited this species as *M. leprieuri* proposed later that it might be a subspecies of *M. leprieuri* or an independent species (*M. arabica* Daccordi, in litt.). I prefer at the moment to place this species to *M. leprieuri* before Lefèvre's type is investigated.

Macrocoma sacra (Lopatin, 1983) (Fig. 41)

Pseudocolaspis sacra Lopatin, 1983. — Fauna of Saudi Arabia 5: 208.

Material: Saudi Arabia: 1 ex., Makkah, Bani Omar, 1730 m, 22-24.VIII.1985.

Distribution: Saudi Arabia.

Macrocoma saudica n. sp. (Fig. 42)

Holotype: ♂, Saudi Arabia, Rawdat Khairam, 2.V.1984. — Paratypes: Saudi Arabia: 1 ♂, Naqben, 1050 m, 28-30.IV.1985, W. Büttiker, LM; 2 ♀♀, Riyadh, 2.V.1984, A.S. Talhouk; 1 ♀, Sah al Rimth, 750 m, 24-25.IV.1981, W. Büttiker.

Description: Green or aeneous. Six basal segments of antennae, labrum and legs reddish fulvous, apical segments of antennae black. Pubescence silvery white. Body robust. Head narrow, with anterior margin of clypeus deeply angularly emarginate. Frons not broadened on sides. Surface shining, densely punctate. Antennae with third segment shorter than second, segments 4-6 subequal, a little longer than segment 3, next segments broadened, segment 7 elongate-triangular, segments 8-10 slightly wider than long. Prothorax 1.2 times as wide as long and 1.5 times as wide as head with eyes, flattened above, with a transverse impression behind anterior margin, side margins strongly rounded; surface shining, densely punctate with long and thin adpressed pubescence. Scutellum semicircular, sparsely punctate. Elytra 1.15 times as long as wide and 1.2 times as wide as prothorax, narrowing caudad and broadly rounded at apex; humeri very distinct but not very prominent. Surface densely punctate, with regular rows of short erect hairs and very dense and long adpressed pubescence. Femora thick, anterior ones with an extremely small tooth, mid and hind ones not toothed. Tibiae straight, moderately strongly broadened at apex. Tarsi thin, fore tarsi of male broadened, especially segment 1. Aedeagus (Fig. 42) bidentate at apex. Length of body 4.8-5.2 mm.

Affinities: Near *M. budura* n. sp., but clypeus deeply emarginate, femora with a short tooth, aedeagus with apical emargination.

Distribution: Saudi Arabia.

Eryxia gracilipes Lefèvre, 1890

Eryxia gracilipes Lefèvre, 1890. — Ann. Soc. Ent. Fr. (6) 10:57.

Distribution: South Yemen.

Eryxia grandis Lefèvre, 1890

Eryxia grandis Lefèvre, 1890. — Ann. Soc. Ent. France 1890 (6) 10: 57.

Iranomolpus badius Lopatin, 1979. — Ent. Review 58 (3): 588 (n. syn.).

Andosiomorpha argentata Lopatin, 1981. — Ent. Review 60 (3): 623 (n. syn.).

Eryxia grandis. — Daccordi 1979: 307; 1983: 227.

Iranomolpus badius. — Lopatin 1983: 208.

Material: Saudi Arabia: 1 ex., Wadi Gaanah, 13-14.II.1980; 2 exs, Wadi Dhiyan, 830-1050 m, 7.III.1984; 1 ex., Fayfa nr. Jizan, 27-31.III.1984, C. Holzschuh; 1 ex., Asir Mountains, Mahalel, 4.IV.1983, C. Holzschuh; 1 ex., Musandam, V.1981; 1 ex., Thumama park, 84 km N of Riyadh, 6.IV.1985, 600 m, H. Kessler; 1 ex., Wadi Juwa, 8.II.1986, J. Grainger. — Oman: 1 ex., Wadi Adai, 25 km S of Muscat, 3.II.1982, C. Green; 1 ex., Jabal Akhdar, 2000 m, 21.V.1981, T. Larsen; 2 exs, Rostaq, 5.V.1981, T. Larsen; 1 ex., Dhofar, X.1979, T. Larsen; 4 exs, N of Sama il Qaylah, 400 m, 21-22.IV.1985, C. Holzschuh; 4 exs, 7 km SE of Dibab, 60 m, 17-18.IV.1985, K. Smithe; 1 ex., SE of Muscat, Wadi Mayh, 200 m, 11-12.IV.1985, C. Holzschuh; 1 ex., Madinat Qaboos, 2.IV.1985, C. Holzschuh; 7 exs, N of Sama il Qaylah, 400 m, 22.IV.1985, C. Holzschuh; 2 exs, SE of Dibab, 60 m, 17-18.IV.1985, M.D. Gallagher; 8 exs, Wadi Mayh, 200 m, 11-12.IV.1985, C. Holzschuh.

Distribution: Saudi Arabia, North Yemen, South Yemen, Ethiopia, Iran.

Remarks: Genera *Iranomolpus* Lopatin, 1979, and *Andosiomorpha* Lopatin, 1981, are new synonyms of the genus *Eryxia* Lefèvre, 1890.

Colasposoma densatum Fairmaire, 1887

Colasposoma densatum Fairmaire, 1887. — Ann. Soc. Ent. France (6) 7: 949.

Colasposoma densatum. — Daccordi 1983: 227.

Material: Saudi Arabia: 1 ex., Fayfa, 20.VII.1982.

Distribution: North Yemen, Somali.

***Euryope rubra* (Latreille, 1807)**

Eumolpus rubra Latreille, 1807. — Gen. Crust. Ins. 3: 56.

Euryope rubra. — Bryant 1957: 354.

Material: Saudi Arabia: 1 ex., Jeddah, 15.XII.1982; 1 ex., Jeddah, 17.XII.1984; 1 ex., Makkah, 106 m, XII.1981; 1 ex., Fayfa, 15.VII.1981; 1 ex., Jizan, 22.XII.1980.

Distribution: Saudi Arabia, South Yemen, West Africa.

***Pachnephorus conspersus* Gerstaecker, 1871**

Pachnephorus conspersus Gerstaecker, 1871. — Arch. Naturg. 37: 81.

Pachnephorus conspersus. — Bryant 1957: 354; Daccordi 1983: 228.

Material: Saudi Arabia: 1 ex., Jizan on Red Sea, 25-26.III.1983, C. Holzschuh; 2 exs, Fayfa nr. Jizan, 27-31.III.1983, C. Holzschuh.

Distribution: North Yemen, South Yemen, East Africa.

***Chloropterus lefevrei* Reitter, 1890**

Chloropterus lefevrei Reitter, 1890. — Wien. Ent. Zeit. 9: 198.

Chloropterus lefevrei. — Lopatin 1979: 303; 1983: 208.

Material: Saudi Arabia: 2 exs, Najran-Khamis-Mushayt, 90 km from Mushayt, 1210 m, 25.III.1983, C. Holzschuh; 1 ex., Wadi Harran, 220 m, 12-13.V.1983; 1 ex., Wadi Dawasir, 660 m, 24.III.1983, C. Holzschuh.

Distribution: Saudi Arabia, Transcaucasus, Iran, Central Asia.

***Chloropterus politus* Berti & Rapilly, 1973**

Chloropterus politus Berti & Rapilly, 1973. — Ann. Soc. Ent. France (N.S.) 9 (4): 877.

Chloropterus politus. — Lopatin 1983: 208 (erroneously for Saudi Arabia).

Material: Oman: 7 exs, N of Sama il Qaylah, 400 m, 22.IV.1985, C. Holzschuh; 2 exs, Rostaq, 5.V.1981, T. Larsen.

Distribution: Oman, Iran.

***Microeurydemus africanus* (Jacoby, 1900)**

Pseudosyagrus africanus Jacoby, 1900. — Proc. Zool. Soc. Lond.: 228.

Material: Saudi Arabia: 1 ex., Wadi Daykah, 600 m, 3-4.IV.1980; 3 exs, Wadi Tabalah, 19.X.1979; 1 ex., Wadi Minsah, 550 m, 7-8.IV.1983; 4 exs, Wadi Juwa, 8.II.1986; 1 ex., J. Lebaka, 24.III.1985, J. Grainger.

Distribution: Saudi Arabia, East Africa.

Remarks: The first record from Arabia. The genus needs revision, because many species, including three Arabian ones, differ mostly in colouration, which seems to be variable enough.

***Microeurydemus flavescens* Bryant, 1942**

Microeurydemus flavescens Bryant, 1942. — Ann. Mag. Nat. Hist. 9: 514.

Microeurydemus flavescens. — Bryant 1957: 354.

Chloropterus politus. — Lopatin 1983: 208.

Material: Saudi Arabia: 1 ex., Jabal al Hamariyah, 28.IV.1987; 1 ex., Suwaydarah, 910 m, 30.IV.1981. — Oman: 1 ex., 7 km SE of Dibab, 60 m, 17-18.IV.1985, M.D. Gallagher; 4 exs, Sahil al Jazir, Wadi Haytam, 10-13.V.1983, M.D. Gallagher.

Distribution: Saudi Arabia, South Yemen, Oman, Uganda.

***Microeurydemus semivittatus* (Jacoby, 1899)**

Eurydemus semivittatus Jacoby, 1899. — Ann. Mus. Civ. Genova 39: 525.

Microeurydemus semivittatus. — Daccordi 1983: 228.

Material: Saudi Arabia: 1 ex., 111 km before Al Ula, 860 m, 21.IV.1979.

Distribution: North Yemen, Saudi Arabia, Somalia, Chad.

Remarks: This specimen was already recorded by Lopatin as *Chloropterus politus* Berti & Rapilly, 1973.

Subfamily **Chrysomelinae***Crosita aeneipennis* (Reiche, 1858)

Chrysolina aeneipennis Reiche, 1858. — Ann. Soc. Ent. France (3) 6: 328.

Material: Saudi Arabia: 1 ex., Wadi Shija, 9.XI.1977.

Distribution: Saudi Arabia, Syria, Palestine, Egypt.

Remarks: The first record from Arabia.

Crosita grata brancuccii Daccordi, 1982 (n. comb.)

Crosita brancuccii Daccordi, 1982. — Entom. Basiliensia 7: 406.

Distribution: Oman; species occurs in Afghanistan, Iran, Middle Asia, west to Sinai.

Remarks: This form has the same structure of aedeagus as *C. grata* Faldermann but differs in having the upperside more greenish and prothorax more sparsely punctured. It also has a different distribution and therefore might be considered as a subspecies of *C. grata*.

Crosita turanica Reitter, 1888 (Fig. 43)

Crosita turanica Reitter, 1888. — Verh. Naturf. Ver. Brunn 27: 31.

Material: Saudi Arabia: 1 ex., Wadi Waji, 23.IV.1982.

Distribution: Saudi Arabia, Middle Asia.

Remarks: The first record from Arabia.

Colaphus pulchellus arabicus n. ssp.

Holotype: Saudi Arabia, Hufuf, 12.IV.1981, BMNH. — Paratype: 1 ex., same locality, LM.

Distribution: Saudi Arabia; nominative form is known from Morocco, Algeria; indicated also for Sinai.

Remarks: This form has a very characteristic bronze colouration of the body and clearly differs from *C. pulchellus*, which is always invariably green. It was found to occur in Saudi Arabia, far from the distribution area of the nominative form (north-western Africa). Therefore, it has all characteristics of a distinct subspecies and is not just considered as a colour variation.

Colaphus sophiae Schaller, 1783

Colaphus sophiae Schaller, 1783. — Abh. Hall. Ges. 1: 272.

Colaphus sophiae. — Bryant 1957: 354.

Distribution: Saudi Arabia, widely distributed in south Europe and Caucasus.

Remarks: It seems to be a wrong determination; very possibly it might be the preceding species.

Subfamily **Galerucinae***Diorhabda octocostata* Gahan, 1896

Diorhabda octocostata Gahan, 1896. — Ann. Mag. Nat. Hist. (6) 18: 460.

Diorhabda octocostata. — Bryant 1957: 354.

Material: Saudi Arabia: 6 exs, Jizan, III-VII.1981; 10.II.1982; 1-2.III.1984.

Distribution: Saudi Arabia, South Yemen, Syria.

Aulacophora foveicollis (Lucas, 1849)

Galeruca foveicollis Lucas, 1849. — Expl. Alger. Ent.: 542.

Aulacophora foveicollis. — Bryant 1957: 354; Shalaby 1961: 226; Beccari 1971: 252.

Haltica foveicollis. — Shalaby 1962: 341; Beccari 1971: 253.

Material: Saudi Arabia: 3 exs, Fayfa, 22.XII.1980, 1 ex., Fayfa, 13.VII.1981; 1 ex., Jizan, 15.VIII.1981. — Oman: 1 ex., Dhofar, Tawi Atair, Jabal Qara, 26.II.1983, Barnes; Dhofar, 20.II.1989, W. Wittmer.

Distribution: Saudi Arabia, North Yemen, Oman, Mediterranean region, Iran, Afghanistan, India.

Ecology: Feeding on Cucurbitaceae. In Saudi Arabia this species was registered on water melon, winter squash, *Cucumis* and occasionally on *Hibiscus*, *Lycopersicum*. A pest of cultivated Cucurbitaceae.

Leptaulaca fissicollis Thompson, 1858

Leptaulaca fissicollis Thompson, 1858. — Arch. Ent. 2: 218.

Leptaulaca festiva. — Bryant 1957: 354.

Distribution: North Yemen, East Africa, Guinea.

Asbecesta cyanipennis Harold, 1877

Asbecesta cyanipennis Harold, 1877. — Mitt. Münch. Ent. Ver. 1: 110.

Asbecesta cyanipennis. — Bryant 1957: 354.

Material: South Yemen: 2 exs, El Kubar, 1903, Bury.

Distribution: South Yemen, Egypt, Guinea, Central Africa.

Asbecesta senegalensis Allard, 1888

Asbecesta senegalensis Allard, 1888. — Ann. Soc. Ent. France (6) 8: 200.

Material: Saudi Arabia: 1 ex., Jizan, 23.II.1979. — Yemen: 1 ex., Sanaa, 24.X.1931, Filipov; 4 exs, Wadi Zabid, III.1971, A. Szalay-Marzso.

Distribution: Saudi Arabia; North Yemen, West Africa.

Remarks: The first record from Arabia.

Diacantha sp.

Material: Saudi Arabia: 1 ex., Wadi al Faraah near Yumbo, 180 m, 19.IV.1979.

Distribution: Saudi Arabia.

Remarks: The first record from Arabia.

Mimastra gracilis Baly, 1878

Mimastra gracilis Baly, 1878. — Cist. Ent. 2: 378.

Material: Saudi Arabia: 1 ex., Khoda, 1890 m, 30.IX.1982.

Distribution: Saudi Arabia, Himalayas.

Remarks: The first record from Arabia.

Lamprocopa delata (Erichson, 1843)

Copa delata Erichson, 1843. — Arch. Naturg. 9: 165.

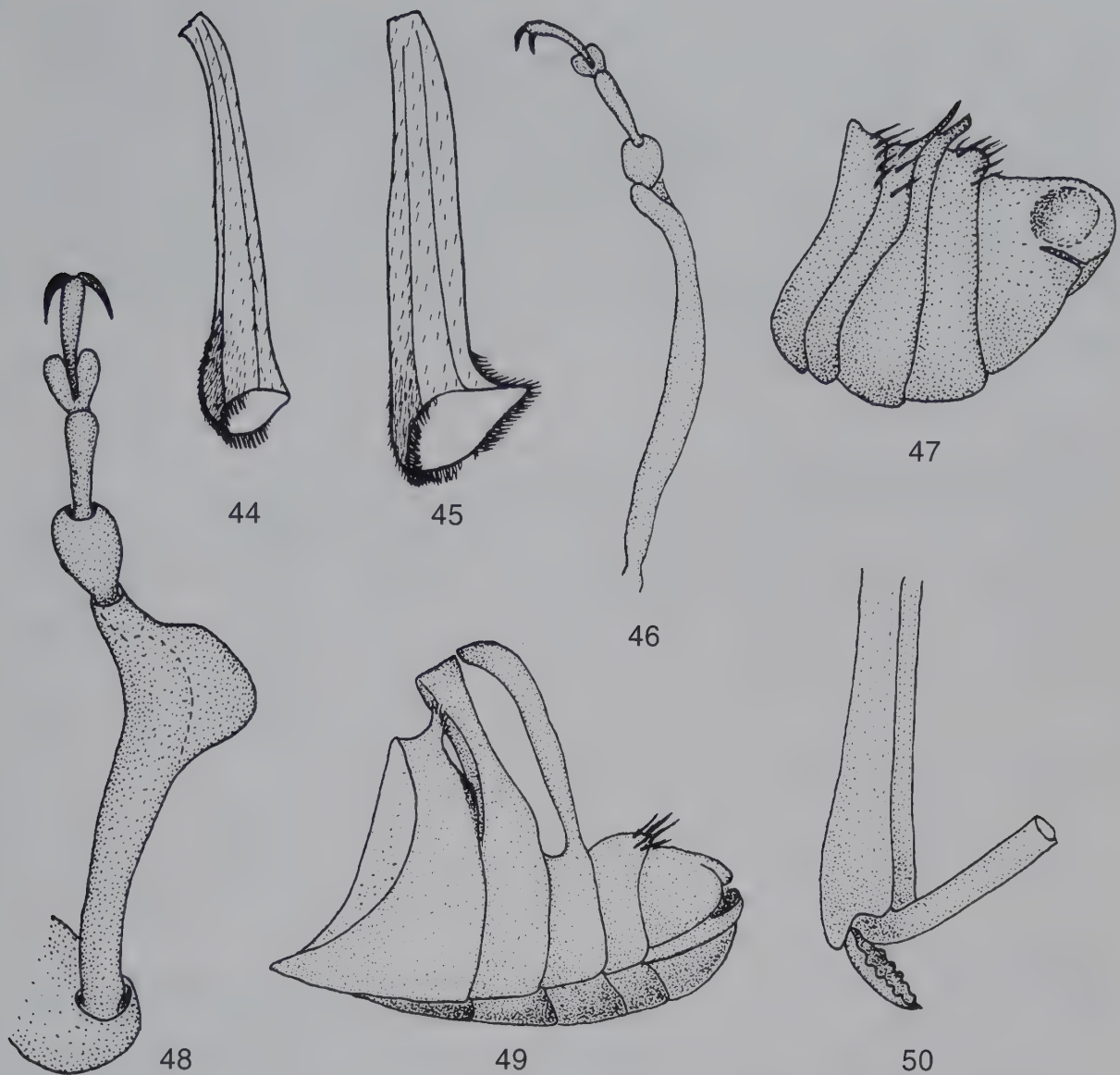
Lamprocopa delata. — Bryant 1957: 354.

Distribution: North Yemen, East Africa, north to Ethiopia, Angola.

Calomicrus millingeni Pic, 1915 (Figs 46, 47)

Calomicrus millingeni Pic, 1915. — Échange 31: 18.

Material: A total of 263 specimens were collected at altitudes of 180-1440 m. For this very abundant species I give only a list of localities: Saudi Arabia: Wadi Ellah, Wadi Fayidah, Wadi Shumran, Wadi Hanaq, Wadi Majarish, Wadi Shuqub, Wadi



Figs 44-50: 44, *Macrocoma buettikeriana*, hind tibia; 45, *M. lepieuri*, hind tibia; 46, *Calomicrus millingeni*, ♂, mid tibia; 47, same, abdomen; 48, *C. buettikeri* n. sp., ♂, mid tibia; 49, same, abdomen; 50, *Yemenaltica*, hind tibia.

Nissah, Wadi Tinan, Wadi Ghamra, Wadi Turabah, Wadi Karrar, Wadi Naqben, Wadi al Faraah, Wadi Marwani, Wadi Shaib, Wadi Awsat, Adnan, Al Wahba, Al Ula, Artawiyah, Aifresh, Badr Hunayn, Khaybar, Hilwah, Sirar, Nuqrah, Kushm Dibi, Hudenah, Dar Hayl, Medina, Naqben, Harithi, Kushm al Buwaybiyat, Jeddah, Taif. — Oman: Wadi Adai, Wadi Mayh, Sayq, Tawi Sadh, Musandam, Al Sib, Dhofar.

Distribution: Saudi Arabia, Oman.

***Calomicrus buettikeri* n. sp. (Figs 48, 49)**

Holotype: ♂, Saudi Arabia, Maraba, 16.X.1979, W. Büttiker.

Description: Pale fulvous, apical antennal segments slightly infusate, base of hind tarsomere 1 black. Body comparatively broad, flattened above. Head more narrow than prothorax, eyes large; frons as broad as eye, shagreened and punctate; clypeus triangular, punctate. Antennae with segments 2 and 3 equal, moderately short, segment 4 as long as segments 2 and 3 combined,

next segments subequal, a little shorter than second. Prothorax 1.5 times as broad as long, with obtuse angles and feebly rounded side margins, surface shining, with a few very feeble, more or less longitudinal impressions, densely punctate. Scutellum triangular, impunctate. Elytra about 1.5 times as long as broad, shining, finely punctate, with short sparse erect hairs. Anterior tarsus with segment 1 elongate-triangular, a little longer than next one. Mid tibiae curved, strongly broadened at apex, mid tarsi with segment 1 broadened (Fig. 48). Hind tarsi with segment 1 longer than next ones combined. Abdomen with rounded lobes on sternites 2 and 3 and with erect hairs on sternite 1 (Fig. 49). Length of body 3.8 mm.

Affinities: Near *C. millingeni* Pic, 1915, but males with mid tibiae strongly widened before apex and abdominal processes short.

Distribution: Saudi Arabia.

***Calomicrus ophthalmicus* Ogloblin, 1936 (Fig. 51)**

Calomicrus ophthalmicus Ogloblin, 1936. — Fauna USSR 26 (1): 254.

Material: Saudi Arabia: 1 ex., Jeddah-Taif, 1200-1800 m, 1.V.1979; 1 ex., Wadi Fayidah, 130 m, 14-15.IX.1983. — Oman: 2 exs, N of Sama il Qaylah, 400 m, 22.IV.1985, C. Holzschuh; 2 exs, Sayq, 19-22.III.1986; 2 exs, Fanjah, Wadi Fanjah, 150 m, 5-9.IV.1985, C. Holzschuh; 1 ex., Muscat, Madinat Qaboos, 50 m, 2.IV.1985 C. Holzschuh; 2 exs, Mintirib, 269 m, 14.VII.1986; 1 ex., Baushar, 20.X.1985, M.D. Gallagher.

Distribution: Saudi Arabia, Oman, Iran.

Remarks: The first record from Arabia.

***Luperodes quaternus* Fairmaire, 1880**

Luperodes quaternus Fairmaire, 1880. — Naturaliste 2: 316.

Luperodes quaternus. — Bryant 1957: 354.

Distribution: South Yemen, Tropical Africa.

***Monolepta arabica* n. sp. (Fig. 52)**

Holotype: ♂, Saudi Arabia, Wadi Shaib Luha, 27.V.1976, W. Büttiker. — Paratypes: Saudi Arabia: 1 ex., same locality; 27 exs, Jabal al Hamariyah, 28.IV.1981, 3 exs LM; 2 exs, Naqben, 1050 m, 28-30.IV.1985; 3 exs, Harithi, 1910 m, 10-11.V.1984; 1 ex., Jal Khartam, 22.IV.1981.

Description: Body pale flavous, apex of pygidium sometimes infusate. Elongate-ovate, feebly shining. Head with transverse frontal tubercles and a triangular clypeus, frons and vertex with a dense microsculpture and fine punctures. Antennae about half as long as body, fourth segment a little shorter than first or 2 and 3 combined, but a little longer than third; latter a little longer than second, next segments slender and elongate. Prothorax 1.7 times as broad as long, subquadrangular, slightly narrowing anteriorly, with side margins almost straight; surface densely microsculptured and extremely finely punctate, without impressions. Elytra 1.6 times as long as broad, microsculptured and densely punctate. Segment 1 of hind tarsus a little longer than next segments combined. Aedeagus (Fig. 52) with a bidentate apex. Length of body 3.2-4.2 mm.

Affinities: Near *M. oryzae* Bryant, from Senegal and French Sudan, but differs in the structure of the antennae, colouration and sculpture of the upperside.

Distribution: Saudi Arabia.

***Monolepta arvensis* Bryant, 1957**

Monolepta arvensis Bryant, 1957. — Ann. Mag. Nat. Hist. 10 (12): 360.

Distribution: South Yemen.

Monolepta bioculata Fabricius, 1781

Monolepta bioculata Fabricius, 1781. — Spec. Ins. 1: 154.

Monolepta bioculata. — Bryant 1957: 354.

Material: Saudi Arabia: 1 ex., Wadi Nimar, 1600 m, 19-20.V.1983.

Distribution: Saudi Arabia, South Yemen, South Africa.

Monolepta heydeni Joannis, 1866 (Fig. 53)

Monolepta heydeni Joannis, 1866. — Abeille 3: 156.

Material: North Yemen: 1 ex., Ill, 2000 m, 15-22.V.1980, T. Larsen.

Distribution: North Yemen, Egypt.

Remarks: The first record from Arabia.

Monolepta lepida Reiche, 1858

Monolepta lepida Reiche, 1858. — Ann. Soc. Ent. France (3), 6: 254.

Material: Saudi Arabia: 1 ex., Thanomah, 1950 m, 11.IV.1980; 1 ex., Jizan, 1.III.1984, A.S. Talhouk; 1 ex., An Nimas, 18.VII.1981; 1 ex., Al Alayyah, 1950 m, 8-10.IV.1979; 1 ex., Wadi Nimar, 1500 m, 19-20.V.1983. — Oman: 5 exs, Dhofar, X.1979, T. Larsen; 1 ex., 17.II.1989, W. Wittmer,

Distribution: Saudi Arabia, North Yemen, Oman, Palestine.

Monolepta pygidialis Jacoby, 1906 (Fig. 54)

Monolepta pygidialis Jacoby, 1906. — Trans. Ent. Soc. Lond.: 41.

Monolepta pygidialis. — Bryant 1957: 354.

Material: Saudi Arabia: 6 exs, Wadi ad Dilla, 1120 m, 17.X.1979; 1 ex., Wadi Kisan, 21.XII.1984, A.K. Nasher.

Distribution: Saudi Arabia, South Yemen, Natal.

Monolepta rubricosa Gerstaecker, 1871

Monolepta rubricosa Gerstaecker, 1871. — Arch. Naturg. 37: 83.

Monolepta rubricosa. — Bryant 1957: 354.

Distribution: South Yemen, East Africa.

Monolepta saudica n. sp. (Fig. 55)

Holotype: ♂, Saudi Arabia, Thanomah, 1950 m, 11.IV.1980, W. Büttiker. — Paratypes: Saudi Arabia: 1 immature ♂, Riyadh, 3.X.1978; 1 ♂, Adama, 17.IV.1980, LM; 1 ♀, Harithi, 18-19.IV.1985, all W. Büttiker.

Description: Pale flavous, segment 1 of hind tarsi with a black base. Body narrow, elongate. Head with large eyes and a narrow frons, latter as broad as length of antennomere 1. Frontal tubercles elongate-triangular. Frons and vertex shagreened, indistinctly punctate. Antennae of male about 2/3 of body length, with very short segments 2 and, especially, 3, segment 4 distinctly longer than first and 2.5 times as long as segments 2 and 3 combined; in female this segment as long as first or 2 and 3 combined; next segments in both sexes subequal, a little shorter than segment 4. Prothorax 1.6 times as broad as long, slightly broadened anteriorly, with straight side margins; surface shining, with feeble lateral depressions, distinctly punctate. Elytra about twice as long as broad, shining, densely punctate. Segment 1 of hind tarsus 1.5 times as long as next segments combined. Aedeagus Fig. 55. Length of body 4.0-4.4 mm.

Affinities: Near *M. arabica* n. sp., but prothorax with depressions and antennal segment 4 very long.

Distribution: Saudi Arabia.

Monolepta sp. (prope *M. saudica* n. sp.)

Material: Saudi Arabia: 1 ex., N Hijaz, 16 km W of Badr Hunayn, 18.IV.1979.

Dercetina sp.

Material: Saudi Arabia: 1 ex., Baharah, 12.VI.1978; 1 ex., Riyadh, Petrified Forest, 26.III.1976.

Remarks: This is the first record of the genus in Arabia.

Subfamily Alticinae

Psylliodes hospes Wollaston, 1854

Psylliodes hospes Wollaston, 1854. — Ins. Mader.: 449.

Psylliodes hospes. — Doguet 1979: 315; 1984: 366.

Distribution: Saudi Arabia, South Europe, North Africa including Egypt.

Psylliodes persica Allard, 1866 (Fig. 56)

Psylliodes persica Allard, 1866. — Abeille 3: 437.

Psylliodes persica. — Doguet 1979: 315.

Material: Saudi Arabia: 1 ex., Harithi, 1910 m, 18-19.IV.1985.

Distribution: Saudi Arabia, Caucasus, Near East, Iran, Middle Asia.

Psylliodes peyerimhoffi Heikertinger, 1916 (Fig. 57)

Psylliodes peyerimhoffi Heikertinger, 1916. — Ent. Blatt. 12: 33.

Psylliodes peyerimhoffi. — Doguet 1979: 315.

Distribution: Saudi Arabia, Sinai, Libya, Palestine.

Psylliodes peyerimhoffi moricandiae Peyerimhoff, 1925

Psylliodes peyerimhoffi moricandiae Peyerimhoff, 1925. — Ann. Soc. Ent. France 44: 15.

Psylliodes peyerimhoffi moricandiae. — Doguet 1979: 315.

Material: Saudi Arabia: 1 ex., Tabuk, 1450 m, 10.XI.1988; 1 ex., Suwaydarah, 910 m, 30.IV.1981.

Distribution: Saudi Arabia, Algeria, Tunis.

Blepharida arabica n. sp.

Holotype: ♀, Saudi Arabia, Fayfa, 1.IV.1983, W. Büttiker.

Description: Body reddish fulvous with elytra and sides of prothorax more pale; antennae not infusate at apex; a thick side margin of prothorax black; elytra with a humeral spot and six spots at outermost interspace black, all rows pitchy dark.

Head shagreened, clypeus sparsely punctate, frons strongly punctate on sides, the middle of frons and vertex smooth. Proportions of antennal segments as 10-5-6-6-6-5-5-6-6-6-8. Prothorax 2.1 times as broad as long, anterior grooves about half as long as prothorax, each with 6-7 deep punctures; surface densely shagreened, impunctate, with traces of a transverse impression before base and a central impressed line. Elytra 1.4 times as long as wide, with regular rows and shagreened interspaces, latter distinctly convex behind the middle. Mid and hind tibiae strongly angulate on outerside before apex. Length of body 8.8 mm, width 5.2 mm.

Affinities: Near *B. sacra* Weise, from Syria, and *B. ertli* Weise, from East Africa, but differs in the larger size and black lateral margins of the prothorax.

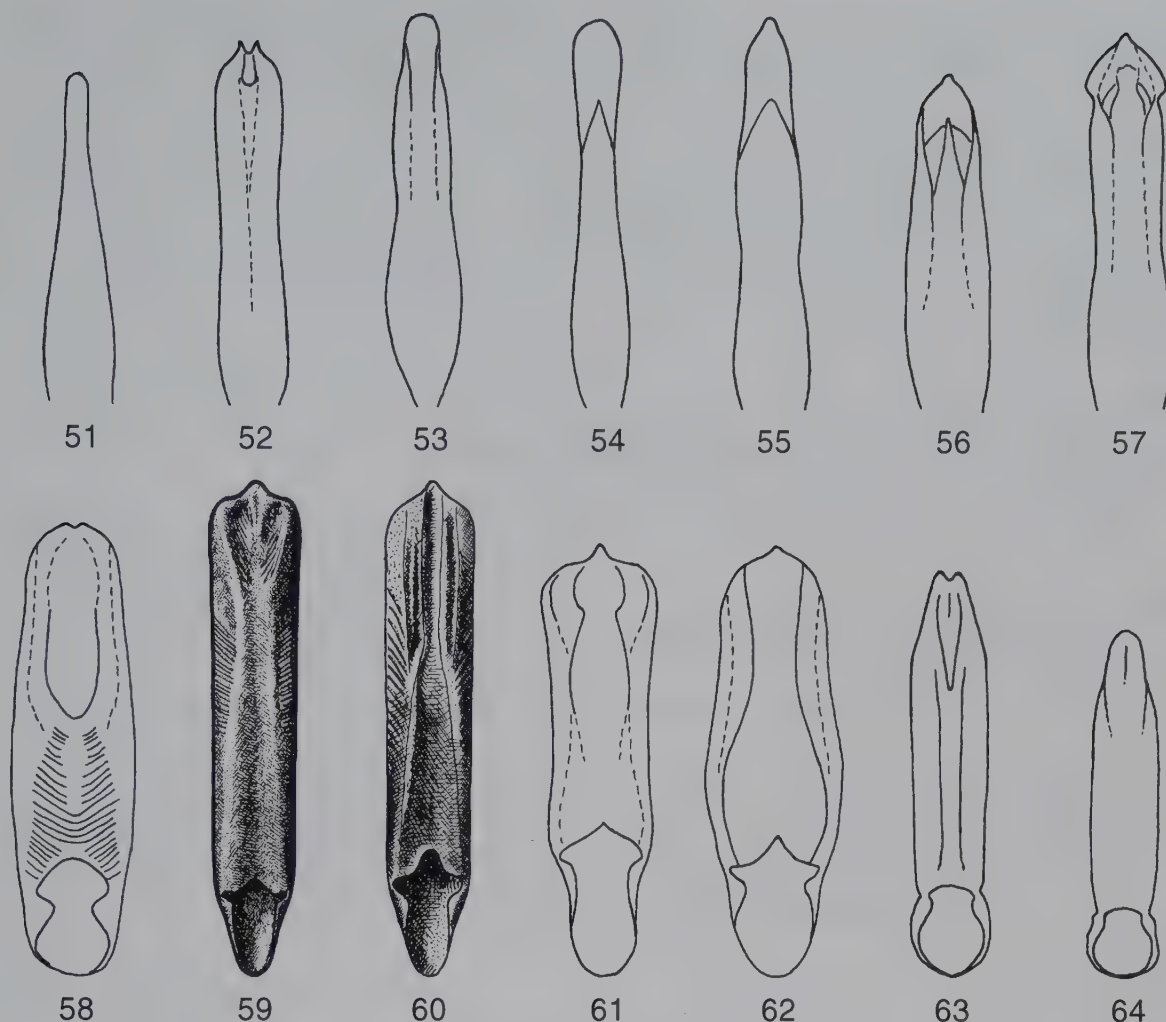
Distribution: Saudi Arabia; seems to be Arabian endemic.

Chaetocnema cephalica Bechyné, 1960

Chaetocnema cephalica Bechyné, 1960. — Bull. Inst. Sci. nat. Belg. 36: 27.

Chaetocnema cephalica. — Doguet 1984: 365.

Distribution: Saudi Arabia, Zaire.



Figs 51-64: Aedeagus, dorsal view: 51, *Calomicrus ophthalmicus*; 52, *Monolepta arabica* n. sp.; 53, *M. heydeni*; 54, *M. pygidialis*; 55, *M. saudica* n. sp.; 56, *Psylliodes persica*; 57, *P. peyerimhoffi*; 58, *Chaetocnema wollastoni*; 59, *Altica foveigera*; 60, *A. pyritosa*; 61, *Epithrix dieckmanni*; 62, *E. priesneri*; 63, *Podagrica decolorata*; 64, *P. pallidicolor*.

Chaetocnema hortensis (Geoffroy, 1785)

Altica hortensis Geoffroy, 1785. — Ent. Paris 1: 98.

Chaetocnema concinnipennis. — Bryant 1957: 354; Doguet 1979: 315.

Chaetocnema hortensis. — Scherer 1972: 15; Doguet 1984: 365.

Distribution: Saudi Arabia, North Yemen, transpalaeartic; also Chad and Sudan.

Ecology: Feeding on Poaceae, pest of agricultural cereals.

Chaetocnema ljuba Bechyné, 1955

Chaetocnema ljuba Bechyné, 1955. — Ent. Arb. Mus. Frey 6: 551.

Chaetocnema ljuba. — Scherer 1978: 266.

Distribution: North Yemen, Sudan, Somalia.

Chaetocnema pulla Chapuis, 1879

Chaetocnema pulla Chapuis, 1879. — Ann. Mus. Civ. Genova 15: 14.

Chaetocnema basalis. — Bryant 1957: 354; Doguet 1979: 314.

Chaetocnema pulla. — Scherer 1978: 266; Doguet 1984: 365.

Distribution: Saudi Arabia, North Yemen, South Yemen, west, central and east Africa, north-east to Ethiopia.

***Chaetocnema wollastoni* Baly, 1877 (Fig. 58)**

Chaetocnema wollastoni Baly, 1877. — Trans. Ent. Soc. Lond.: 167.

Chaetocnema cognata. — Bryant 1957: 354; Doguet 1979: 315.

Chaetocnema wollastoni. — Scherer 1978: 266; Doguet 1984: 365.

Distribution: Saudi Arabia, North Yemen, South Yemen, Chad, Sudan, Ethiopia, central and south Africa.

***Altica bicarinata* Kutschera, 1860**

Altica bicarinata Kutschera, 1860. — Wien. Ent. Monatsschr. 4: 14.

Aulacophora bicarinata. — Shalaby 1962: 341 (erroneously as *Aulacophora*).

Aulacophora bicarinata. — Beccari 1971: 252 (erroneously as *Aulacophora*).

Distribution: Saudi Arabia, Near East, Egypt.

***Altica foveigera* Harold, 1877 (Fig. 59)**

Altica foveigera Harold, 1877. — Mitt. Münch. Ent. Ver.: 107.

Altica foveigera. — Bryant 1957: 354.

Distribution: South Yemen, east, central and south Africa, north to Sudan.

***Altica pyritosa* Erichson, 1843 (Fig. 60)**

Altica pyritosa Erichson, 1843. — Arch. Naturg. 9 (1): 266.

Altica pyritosa. — Doguet 1979: 314.

Material: Saudi Arabia: 5 exs, An Nimas, 18.VII.1981.

Distribution: Saudi Arabia, tropical Africa.

***Epithrix dieckmanni* Mohr, 1968 (Fig. 61)**

Epithrix dieckmanni Mohr, 1968. — Ent. Bl. 64: 58.

Epithrix dieckmanni. — Doguet 1979: 314.

Distribution: Saudi Arabia, Jordan, Palestine, Iran.

***Epithrix priesneri* Heikertinger, 1950 (Fig. 62)**

Epithrix priesneri Heikertinger, 1950. — Kol. Rundschau 31: 120.

Epithrix integricollis. — Bryant 1957: 354.

Epithrix priesneri. — Doguet 1979: 314; 1984: 363.

Material: Saudi Arabia: 10 exs, Makkah, 1730 m, 22-24.VIII.1985; 2 exs, Harithi, 1910 m, 11.V.1984; 1 ex., Suway-darah, 910 m, 30.IV.1981. — Oman: 1 ex., Jabal Akhdar, 2000 m, 21.V.1981, T. Larsen.

Distribution: Saudi Arabia, North Yemen, South Yemen, Oman, Egypt.

***Epithrix* sp.**

Epithrix sp. — Doguet 1979: 314.

Distribution: Saudi Arabia.

***Orthocrepis ruficollis* Lucas, 1849**

Orthocrepis ruficollis Lucas, 1849. — Expl. sci. Algiers: 346.

Orthocrepis ruficollis. — Scherer 1978: 265.

Material: Oman: 1 ex., Muscat, 50 m, Madinat Qaboos, 2.IV.1985, C. Holzschuh; 2 exs, W of Bani Khalid, 550 m, 22.IV.1983, M.D. Gallagher. — Saudi Arabia: 1 ex., Jizan, 25-26.III.1983, C. Holzschuh.

Distribution: Saudi Arabia, North Yemen, Oman, Mediterranean countries, North Africa from Morocco to Egypt, West Africa, Sudan, south-west Asia to India and Ceylon.

Phygasia africana (Chapuis, 1879)

Lactica africana Chapuis, 1879. — Ann. Mus. Civ. Genova 15: 16.

Material: Oman: 2 exs, Dhofar, Ain Rzat, 17.II.1989, W. Wittmer.

Distribution: Oman, Ethiopia.

Phygasia sulphureipennis Jacoby, 1899

Phygasia sulphureipennis Jacoby, 1899. — Proc. Zool. Soc. Lond.: 339.

Phygasia sulphureipennis. — Bryant 1957: 354.

Distribution: South Yemen, East Africa, including Ethiopia.

Podagrica decolorata Duvivier, 1892 (Fig. 63)

Podagrica decolorata Duvivier, 1892. — Ann. Soc. Ent. Belg. 36: 372.

Podagrica decolorata. — Scherer 1978: 265.

Distribution: North Yemen, all northern part of Africa south from Sahara.

Podagrica pallidicolor Pic, 1909 (Fig. 64)

Podagrica pallidicolor Pic, 1909. — Échange 25: 154.

Podagrica pallidicolor. — Scherer 1972: 13; 1978: 265; Doguet 1984: 363.

Material: Saudi Arabia: 3 exs, Bani Sharfa, 17.II.1980; 1 ex., Fayfa, 1240 m, 27-31.III.1983, C. Holzschuh; 9 exs, Jizan, 10.II.-1.III.1984, C. Holzschuh; 6 exs, Wadi Juwa, 8.II.1986, J. Grainger; 1 ex., Jizan, 25-26.III.1983, C. Holzschuh; 5 exs, Wadi Majarish, 1020 m, 6.II.1980; 3 exs, Muhayel, 4.III.1986.

Distribution: Saudi Arabia, North Yemen, South Yemen, Egypt, Ethiopia.

Podagrica puncticollis Weise, 1902

Podagrica puncticollis Weise, 1902. — Arch. Naturg. 68 (1): 166.

Podagrica puncticollis. — Bryant 1957: 354; Shalaby 1962: 341; Beccari 1971: 253; Doguet 1979: 308.

Distribution: Saudi Arabia, North Yemen, South Yemen, Oman, Egypt, Tanzania.

Remarks: Feeding on *Hibiscus esculentum*.

***Ethiopia* sp.(n. sp.?)**

Ethiopia sp. — Scherer 1978: 265.

Distribution: North Yemen.

Remarks: G. Scherer indicated this form as a new species but retracted from a description because material consisted only of three poorly preserved females. Another species in Ethiopia.

Hespera fulvicollis Weise, 1924

Hespera fulvicollis Weise, 1924. — Ark. Zool. 16 (22): 23.

Hespera fulvicollis. — Bryant 1957: 354.

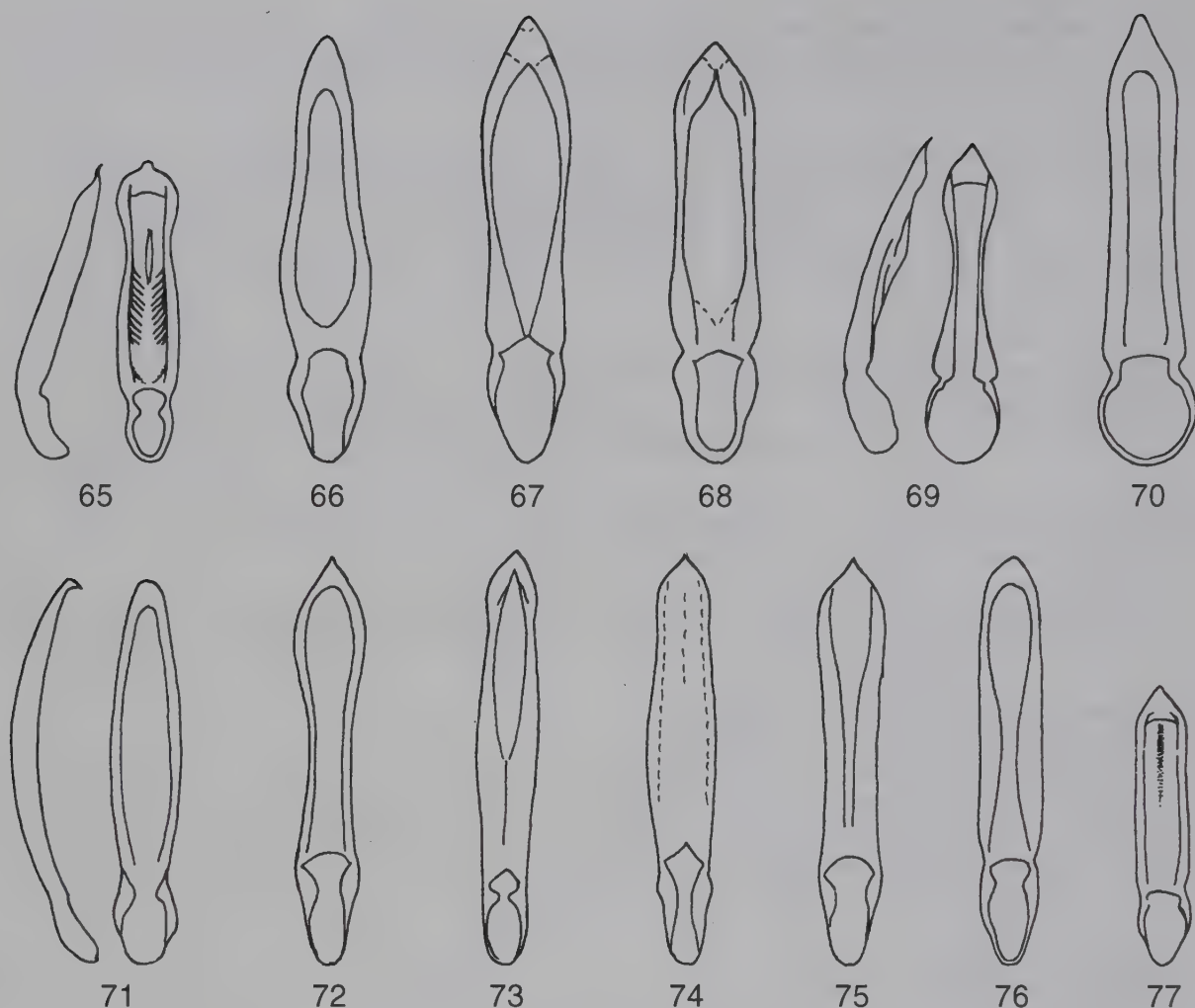
Distribution: South Yemen, central and East Africa.

Longitarsus aeneus Kutschera, 1862

Longitarsus aeneus Kutschera, 1862. — Wien. Ent. Monatsschr. 6: 103.

Longitarsus aeneus. — Bryant 1957: 354.

Distribution: South Yemen, Mediterranean region, Tunis, Libya.



Figs 65-77: Aedeagus, lateral and dorsal view: 65, *Longitarsus arabicus*; 66, *L. buettikeri*; 67, *L. lycopi*; 68, *L. ballotae*; 69, *L. mirei*; 70, *Luperomorpha arabica*; 71, *Phyllotreta buettikeri*; 72, *Ph. cheiranthi*; 73, *Ph. floriensis*; 74, *Ph. peyerimhoffi*; 75, *Ph. variipennis aegyptiaca*; 76, *Aphthona dubia*; 77, *A. wittmeri*.

***Longitarsus arabicus* Doguet, 1979 (Fig. 65)**

Longitarsus arabicus Doguet, 1979. — Fauna of Saudi Arabia 1: 311.

Longitarsus arabicus. — Doguet 1984: 363.

Material: Saudi Arabia: 1 ex., Risayah, 18.X.1974.

Distribution: Saudi Arabia, South Yemen.

***Longitarsus buettikeri* Doguet, 1984 (Fig. 66)**

Longitarsus buettikeri Doguet, 1984. — Fauna of Saudi Arabia 6: 363.

Distribution: Saudi Arabia.

***Longitarsus lycopi* Foudras, 1859 (Fig. 67)**

Longitarsus lycopi Foudras, 1859. — Ann. Soc. Linn. Lyon 6: 239.

Longitarsus ballotae. — Bryant 1957: 354 (misidentification).

Longitarsus lycopi. — Doguet 1979: 313.

Distribution: Saudi Arabia, North Yemen, widespread in Palaearctic.

Ecology: Feeding on *Mentha*.

Longitarsus mirei Doguet, 1979 (Fig. 69)*Longitarsus mirei* Doguet, 1979. — Fauna of Saudi Arabia 1: 313.*Longitarsus mirei*. — Doguet 1984: 362.

Distribution: Saudi Arabia, Palestine.

Longitarsus rutilus Illiger, 1807*Longitarsus rutilus* Illiger, 1807. — Mag. Ins. 6: 67.*Longitarsus rutilus*. — Bryant 1957: 354.

Distribution: South Yemen, south-west Europe, Morocco, Algeria.

Longitarsus sp. 1*Longitarsus* sp. — Scherer 1978: 265.

Distribution: North Yemen.

Longitarsus sp. 2*Longitarsus* sp. — Doguet 1979: 313.

Distribution: Saudi Arabia.

Luperomorpha arabica Doguet, 1979 (Fig. 70)*Luperomorpha arabica* Doguet, 1979. — Fauna of Saudi Arabia 1: 308.

Distribution: Saudi Arabia.

Phyllotreta buettikeri Doguet, 1979 (Fig. 71)*Phyllotreta buettikeri* Doguet, 1979. — Fauna of Saudi Arabia 1: 310.

Distribution: Saudi Arabia.

Phyllotreta cheiranthi Weise, 1903 (Fig. 72)*Phyllotreta cheiranthi* Weise, 1903. — Arch. Naturg. 69: 218.*Phyllotreta cheiranthi*. — Bryant 1957: 354; Scherer 1978: 265; Doguet 1979: 310; 1984: 362.

Material: Saudi Arabia: 1 ex., Abha (Asir), 2260 m, 15.VII.1981, A.S. Talhouk; 1 ex., Wadi Kisan, 21.XII.1984, A.K. Nasher; 1 ex., Harithi, 10-15.IV.1984. — Oman: 1 ex., Tawi Sadh, 650 m, 22.IV.1988, M.D. Gallagher.

Distribution: Saudi Arabia, North Yemen, Oman, tropical Africa except south, north to Sudan.

Phyllotreta flavifrons Jacoby, 1898*Phyllotreta flavifrons* Jacoby, 1898. — Ann. Mus. Civ. Genova 39: 529.*Phyllotreta flavifrons*. — Bryant 1957: 354.

Distribution: North Yemen, South Yemen, Somalia, Sudan, Tanzania.

Phyllotreta florieni Pic, 1910 (Fig. 73)*Phyllotreta florieni* Pic, 1910. — Échange 26: 25.*Phyllotreta florieni*. — Doguet 1984: 362.

Distribution: Saudi Arabia, Egypt, Palestine.

Phyllotreta latevittata Kutschera, 1860*Phyllotreta latevittata* Kutschera, 1860. — Wien. Ent. Monatsber. 4: 307.

Material: Oman: 1 ex., Tawi Sadh, 650 m, 22.IV.1988, M.D. Gallagher.

Distribution: Oman, Mediterranean region.

Phyllotreta mashonana* Jacoby, 1897Phyllotreta mashonana* Jacoby, 1897. — Proc. Zool. Soc. Lond.: 554.*Phyllotreta mashonana*. — Bryant 1957: 354; Doguet 1979: 311.

Distribution: North Yemen, South Yemen, South and east Africa, north to Ethiopia.

Phyllotreta peyerimhoffi* Heikertinger, 1941 (Fig. 74)Phyllotreta peyerimhoffi* Heikertinger, 1941. — Kol. Rundschau 27: 10.*Phyllotreta peyerimhoffi*. — Doguet 1984: 362.

Distribution: Saudi Arabia, Palestine, Jordan.

Phyllotreta tenuimarginata* Jacoby, 1898Phyllotreta tenuimarginata* Jacoby, 1898. — Ann. Mus. Civ. Genova 39: 528.*Phyllotreta tenuimarginata*. — Bryant 1957: 354.

Distribution: North Yemen, Sudan, Somalia.

Phyllotreta variipennis aegyptiaca* Pic, 1911 (Fig. 75)Phyllotreta aegyptiaca* Pic, 1911. — Échange 31: 3.*Phyllotreta variipennis aegyptiaca*. — Doguet 1984: 361.

Distribution: Saudi Arabia, Africa north of Sahara.

Aphthona dubia* Laboissière, 1942 (Fig. 76)Aphthona dubia* Laboissière, 1942. — Expl. Parc. Nat. Albert: 22.*Aphthona asirica* Doguet, 1979. — Fauna of Saudi Arabia 1: 311.*Aphthona dubia*. — Scherer 1978: 265; Doguet 1984: 362.

Material: Saudi Arabia: 3 exs, Jizan, 1.III.1984, A.S. Talhouk; 4 exs, Riyadh, 15.I.1982, A.S. Talhouk; 4 exs, Jazeed, 2200 m, 29.IX.1981; 5 exs, Hesua, 610 m, 27.IX.1981; 1 ex., Jizan, 25-26.III.1983. — Oman: 1 ex., Tawi Sadh, 650 m, 22.IV.1988.

Distribution: Saudi Arabia, North Yemen, Oman, Zaire, Tanzania.

Aphthona lutescens* (Gyllenhal, 1808)Altica lutescens* Gyllenhal, 1808. — Ins. Suec. 3: 546.*Aphthona lutescens*. — Bryant 1957: 354.

Distribution: North Yemen.

Aphthona marshalli* Jacoby, 1908Aphthona marshalli* Jacoby, 1908. — Trans. Ent. Soc. Lond.: 11.*Aphthona marshalli*. — Bryant 1957: 354.

Distribution: North Yemen, South Yemen, West and south Africa.

Aphthona pygmaea* Kutschera, 1861Aphthona pygmaea* Kutschera, 1861. — Wien. Ent. Monatsschr. 5: 246.*Aphthona pygmaea*. — Bryant 1957: 354.

Distribution: North Yemen, South Yemen, Europe, Near East, Middle Asia.

Aphthona thikana* Bryant, 1940Aphthona thikana* Bryant, 1940. — Proc. Soc. Ent. Lond. (B) 9: 44.*Aphthona thikana*. — Bryant 1957: 354.

Distribution: South Yemen, Kenya.

Aphthona whietfieldi Bryant, 1933*Aphthona whietfieldi* Bryant, 1933. — *Stylops* 2: 253.*Aphthona whietfieldi*. — Bryant 1957: 354.

Distribution: North Yemen, South Yemen, Sudan, Somalia, Uganda, Guinea, Nigeria.

Aphthona wittmeri Doguet, 1979 (Fig. 77)*Aphthona wittmeri* Doguet, 1979. — *Fauna of Saudi Arabia* 1: 311.

Distribution: Saudi Arabia.

Aphthona sp. (prope *A. pusilla* Laboissière)*Aphthona* sp. (1). — Doguet 1984: 362.

Distribution: Saudi Arabia.

Aphthona sp.*Aphthona* sp. (2). — Doguet 1984: 362.

Distribution: Saudi Arabia.

Angulaphthona latipennis (Pic, 1921)*Aphthona latipennis* Pic, 1921. — *Échange* 37: 5.*Angulaphthona latipennis*. — Bryant 1957: 354; Scherer 1978: 265.

Material: Saudi Arabia: 1 ex., Fayfa, 1.II.1983.

Distribution: Saudi Arabia, North Yemen, Egypt, Sudan, Somalia, Nigeria, Zaire.

Yemenaltica scorteccii Scherer, 1985 (Fig. 50)*Yemenaltica scorteccii* Scherer, 1985. — *Atti. Soc. Ital. Sci. nat. Mus. Stor. Nat. Milano* 126: 86.

Material: Oman: 1 ex., Muscat, 50 m, Madinat Qaboos, 2.IV.1985, C. Holzschuh.

Distribution: North Yemen, Oman, Arabia.

Polyclada benti Achard, 1922*Polyclada benti* Achard, 1922. — *Fragm. ent.*: 4.*Polyclada benti*. — Bryant 1957: 354.

Material: 1 ex., J. Lebaba, 13.II.1985.

Distribution: Saudi Arabia, South Yemen, Somalia.

Amphimela sp.

Material: Saudi Arabia: 1 ex., Abha, 4.VI.1982.

Subfamily Hispinae

Acmenychus planus Maulik, 1919*Acmenychus planus* Maulik, 1919. — *Ann. Mag. Nat. Hist.* (9) 4: 409.

Distribution: Arabia, "Turkomania Kurdistan" (possibly Iraq).

Dicladispa pallesces Guérin, 1841*Dicladispa pallesces* Guérin, 1841. — *Rev. Zool.*: 13.*Dicladispa pallesces*. — Uhmann 1952: 233; Würmli 1979: 317.

Material: Saudi Arabia: 3 exs, Muhayel, 4.III.1986; 1 ex., Jizan, 1.III.1984, A.S. Talhouk.

Distribution: Saudi Arabia, South Yemen, India.

Dactylispa clavata Weise, 1901

Dactylispa clavata Weise, 1901. — Deutsche Ent. Ztschr.: 235.

Dactylispa clavata. — Bryant 1957: 354.

Material: Saudi Arabia: 1 ex., Al Qatif, 10.V.1980, A.S. Talhouk.

Distribution: Saudi Arabia, North Yemen, East Africa, north to Sudan.

Subfamily Cassidinae

Aspidomorpha gruevi Borowiec, 1985

Aspidomorpha gruevi Borowiec, 1985. — Polsk. Pismo Ent. 55: 451.

Aspidomorpha tecta. — Shalaby 1961: 226; Beccari 1971: 253.

Material: Saudi Arabia: 1 ex., Jeddah, 25.I.1984.

Distribution: Arabia, North Yemen.

Cassida praetimida Spaeth, 1912

Cassida praetimida Spaeth, 1912. — Ann. Mus. Hung. 10: 497.

Cassida praetimida. — Bryant 1957: 354.

Distribution: North Yemen, Senegal, East Africa.

Table 2: A list of synonyms and erroneous identifications mentioned in the literature concerning the Arabian Peninsula (in alphabetical order):

| Synonyms and misidentifications | Present status |
|---------------------------------------------------|------------------------------------------------------------------------------------------------------------|
| <i>Aphthona asirica</i> Doguet | Synonym of <i>Aphthona dubia</i> Laboissière |
| <i>Aspidomorpha tecta</i> Boheman | <i>Aspidomorpha gruevi</i> Borowiec |
| <i>Chaetocnema basalis</i> Baly | <i>Chaetocnema pulla</i> Chapuis |
| <i>Chaetocnema cognata</i> Baly | <i>Chaetocnema wollastoni</i> Baly |
| <i>Chaetocnema concinnipennis</i> Baly | <i>Chaetocnema hortensis</i> Geoffroy |
| <i>Coenobius arabicus</i> Lopatin | Synonym of <i>Isnus biseriatus</i> Chapuis |
| <i>Coptocephala floralis</i> Olivier | <i>Coptocephala crassipes iranica</i> Medvedev |
| <i>Crosita brancuccii</i> Daccordi | <i>Crosita grata brancuccii</i> Daccordi |
| <i>Cryptocephalus arabs</i> Suffrian | Synonym of <i>Cryptocephalus petraeus</i> Suffrian |
| <i>Cryptocephalus elkhaldii</i> Lopatin | Synonym of <i>Cryptocephalus senegalensis</i> Suffrian |
| <i>Cryptocephalus undularis</i> Suffrian | <i>Cryptocephalus petraeus</i> Suffrian |
| <i>Epithrix integricollis</i> Jacoby | <i>Epithrix priesneri</i> Heikertinger |
| <i>Haltica foveicollis</i> Lucas | <i>Aulacophora foveicollis</i> Lucas |
| <i>Iranomolpus badius</i> Lopatin | Synonym of <i>Eryxia grandis</i> Lefèvre |
| <i>Longitarsus ballotae</i> Marsham | <i>Longitarsus lycopi</i> Foudras |
| <i>Melixanthus jordanicus</i> Lopatin | Synonym of <i>Melixanthus granularis</i> Suffrian |
| <i>Merriona bicolor</i> Fabricius (Beccari, 1971) | This species from North America is definitely not possible in Arabia. No doubt, it is a misidentification. |
| <i>Pseudocolaspis millingeni</i> Pic | Synonym of <i>Macrocoma leprieuri</i> Lefèvre |
| <i>Pseudocolaspis sacra</i> Lopatin | <i>Macrocoma sacra</i> Lopatin |
| <i>Syagrus flavescens</i> Bryant | <i>Microeurydemus flavescens</i> Bryant |

ACKNOWLEDGEMENTS

This publication has been supported by an International Science Foundation grant. I am grateful to Dr. M. Brancucci and Prof. W. Büttiker for allowing me to study the material in the Natural History Museum Basel.

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The Calliphoridae (Diptera: Cyclorrhapha) of Oman

John C. Deeming

Abstract: Twenty-one species of Calliphoridae are reported from the Sultanate of Oman for the first time. Three are undescribed species, of which two, *Cosmina ebejeri* and *Rhyncomya bullata*, are described as new. The previously unknown male of *Rhyncomya io* (Peris, 1951) and the puparium of *Pericallimya greatheadi* Zumpt, 1971, are described. Two species not known from Oman, one of them tentatively identified, are recorded from Saudi Arabia.

عائلة Calliphoridae (رتبة ثنائية الأجنحة : Cyclorrhapha) من سلطنة عُمان

جون. س. ديمينغ

خلاصة : يتضمن هذا البحث تسجيلاً جديداً لـ ٢١ نوعاً من Calliphoridae من سلطنة عمان ثلاثة انواع منها لم يسبق وصفها، منها إثنان *Cosmina ebejeri* و *Rhyncomya bullata* تم وصفها على انها أنواع جديدة. وقد تم وصف ذكر النوع *Rhyncomya io* (Peris, 1951) وشرقة النوع *Pericallimya greatheadi* Zumpt, 1971 التي لم تكن معروفة في السابق. كما يحتوي البحث على نوعين غير معروفين من عمان تم تسجيلهما من المملكة العربية السعودية.

INTRODUCTION

This is a family of diverse biology and one that has considerable impact on the environment, agriculture and the health of man and his domestic animals. Larvae of the subfamily Ameniinae are parasitoids of land snails. Those of the Prosthetosomatinae develop in the nests of termites. Most Rhiniinae have larvae associated with termites, but some species have larvae that are predaceous on the egg pods of grasshoppers and locusts. The larvae of Chrysomyinae develop in carrion and those of *Chrysomya* sometimes in wounds of vertebrates (traumatic myiasis) and also in dung, but *Chrysomya bezziana* Villeneuve ("the Old World screw-worm fly") breeds exclusively in wounds, especially in sheep, cattle and man. In the same subfamily *Cochliomyia hominivorax* (Coquerel) ("the New World screw-worm fly") is also a carrion-breeder, but attacks man and his domestic animals. This species was recently inadvertently introduced into North Africa, but fortunately was recognised and was eradicated by the sterile male technique. In the Phormiinae the various species of *Protocalliphora* have larvae which suck the blood of nestling birds and frequently kill them. In the Calliphorinae is to be found the greatest diversity of larval biology. The larvae of *Auchmeromyia senegalensis* (Macquart), (which is better known by its junior synonym *A.*

luteola (Fabricius), (the "Congo floor maggot") suck the blood of sleeping humans. *Cordylobia anthropophaga* (Blanchard & Béranger-Féraud) ("the Tumbu fly") has larvae that develop subcutaneously in man, and other species of the same genus attack other vertebrates. *Booponus indicus* (Austen) is a warble fly of the Indian Elephant. *Lucilia bufonivora* Moniez kills frogs and toads by infesting their nasal cavities and orbits with its maggots. Various species of *Lucilia* and *Calliphora* are known to attack sheep and also to blow meat. The larvae of *Pollenia* prey upon earthworms, as also do certain Australian *Calliphora* species. The larvae of *Hemigymnochaeta* develop in the fungus gardens of termite nests, and those of *Eggisops* are parasitoids of slugs and snails. In terms of adult biology a wide range of calliphorid species is known to contaminate food with pathogens they carry. A peculiar adult biology is found in *Bengalia*, where flies of both sexes pounce upon ants which are carrying larvae and pupae and suck out the liquid contents of the immatures.

Since all of the calliphorid material in the Fauna of Saudi Arabia material held in the Basle Museum is from the Sultanate of Oman, to which I have added my own collections and those of Dr. M.J. Ebejer and Mr. M.D. Gallagher, all from that country, I am restricting the scope of this paper to Oman, though I shall refer to material from elsewhere, especially that collected by Mr. A. van Harten in Yemen.

In the transliteration of Arabic words to English inconsistencies frequently occur, especially when road signs do not agree with names on maps (which are also subject to change). It has transpired that different collectors have given different transliterations for the following:

Baushar = Bowsher, a locality west of Muscat city

Kawr = Khawr or Khor, a locality prefix meaning an inlet from the sea.

These are listed according to the data on individual specimen labels.

The Wahiba Sands and the Eastern Sands are synonymous.

Abbreviations:

BMNH: Natural History Museum, London

MJEC: the personal collection of Dr. M.J. Ebejer

NHMB: Naturhistorisches Museum, Basel

NMWC: National Museums & Galleries of Wales, Cardiff

ONHM: Oman Natural History Museum, Muscat

FAUNISTICS

I know of no records of Calliphoridae from Oman. Of the 21 species encountered in this study, 18 are known to science, two are described as new species and a further one left unnamed due to being represented by material inadequate for full diagnosis. Inclusive of these, nine of the species are native to the arid belt (Eremian) extending from north Africa to Pakistan, ten are essentially Afrotropical species with incursions into the eastern part of this belt, and only three are widely distributed in both Afrotropical and Oriental regions. There is no temperate Palaearctic species in the material. Notable exceptions to the calliphorid fauna of Oman when compared with that of Yemen are the genera *Pollenia* and *Lucilia*. The first is understandable due to the paucity of the earthworm larval prey of *Pollenia* in so dry an environment, but the reason for the lack of *Lucilia* is not so easily explained. With possible exceptions, the material treated here was collected in dry weather, with all the material from Dhofar, which is subject to the monsoon, collected during the dry season.

SYSTEMATICS

Key to the species of Calliphoridae from Oman

- | | | |
|----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|
| 1 | Stem vein of wing on upper side with a row of hairs | 2 |
| — | Stem vein bare (Calliphorinae) | 20 |
| 2 | Thoracic squama apically rounded and lacking dorsal setae. Infra-alar bulla bearing only short pubescence (Rhiniinae) | 3 |
| — | Thoracic squama truncate apically, broadly triangular, its upper surface with erect setulae. Infra-alar bulla bearing long erect setulae (Chrysomyinae) | 17 |
| 3 | Arista dorsally and ventrally with long or short hairs, or almost bare, but never with long dorsal hairs and none ventrally | 4 |
| — | Arista pectinate, with hairs on the dorsal side only | 16 |
| 4 | Arista bare or only pubescent, the longest hairs not or only slightly exceeding one half the width of third antennal segment | 5 |
| — | Arista plumose, the longest hairs at least as long as the third antennal segment is broad | 12 |
| 5 | Prostigmatic bristle present | 6 |
| — | Prostigmatic bristle absent. Cell r 5 closed and petiolate. Only the prescutellar pair of dorsocentrals present | |
| | | <i>Pararhyncomyia cribriformis</i> |
| 6 | Mouthparts greatly reduced. Chaetotaxy of head and thorax short and weak. Dull clay-coloured species with cell r 5 closed and petiolate | |
| | | <i>Villeneuveiella seguyi</i> |
| — | Mouthparts fully functional. Chaetotaxy fully developed. Cell r 5 not petiolate (<i>Rhyncomyia</i>) | 7 |
| 7 | Abdomen shining. Head anteriorly with large shining black spots | 8 |
| — | Abdomen heavily silvery-grey to grey dusted. Head with or without shining black spots | 9 |
| 8 | Humerus completely and scutellum predominantly of a yellow ground colour. Extreme apices of fore and hind tibiae tinged with black | |
| | | <i>Rhyncomyia</i> sp. |
| — | Humerus and scutellum completely black in ground colour. Tibiae yellow throughout | |
| | | <i>Rhyncomyia bullata</i> n. sp. |
| 9 | Males: No black spots evident on parafacialia or jowls | 10 |
| — | Males: Black spots evident on parafacialia or jowls | 11 |
| 10 | Pregenital sternite (5 th) on inner side with compact bristle-like hairs | |
| | | <i>Rhyncomyia jordanensis</i> |
| — | Pregenital sternite lacking such specialised chaetotaxy | |
| | | <i>Rhyncomyia io</i> |
| 11 | Underside of male abdomen with inner margins of tergites bearing compact long fine black hairs | |
| | | <i>Rhyncomyia nigripes</i> |
| — | Underside of male abdomen lacking such striking chaetotaxy | |
| | | <i>Rhyncomyia flavipes</i> |
| 12 | Presutural acrostichal bristles well developed | |
| | | <i>Isomyia terminata</i> |
| — | Presutural acrostichal bristles absent or very weakly developed (<i>Cosmina</i>) | 13 |
| 13 | Wing with a smoky suffusion on costal margin. Section of M 1 + 2 between posterior crossvein and bend about equal in length to the section between bend and wing tip and also to the posterior crossvein. | 14 |
| — | If wing has a smoky suffusion it is a general tint to the membrane. Section of M 1 + 2 between posterior crossvein and bend distinctly shorter than both the section between bend and wing tip and the posterior crossvein | 15 |

- 14 Merging of face with lunula between insertions of antennae twice as wide as base of arista. Mouth-margin strongly projecting between vibrissae. Male without abrupt change in size of eye facets *Cosmina fuscipennis*
- Merging of face with lunula between antennal insertions narrow, as wide as base of arista. Mouth-margin only slightly projecting. Male eye with abrupt change in facet size at two fifths of its height, the upper facets being much larger *Cosmina arabica*
- 15 Propleuron compactly haired *Cosmina viridis*
- Propleuron bare *Cosmina ebejeri* n. sp.
- 16 Sternopleuron and hypopleuron shining. Mesonotum dark dusted, mottled with darker spots at bases of setae *Rhinia apicalis*
- Hypopleuron completely dusted, the sternopleuron on all but its anterior margin. Mesonotum pale grey dusted with three broad shining black longitudinal bands *Stomorphina cribrata*
- 17 Anterior margin and base of wing strongly infusate *Chrysomya regalis*
- Wing hyaline, though the base may be slightly fumose 18
- 18 Anterior thoracic spiracle of a darker colour, blackish brown to dark orange 19
- Anterior thoracic spiracle white to cream-white *Chrysomya albiceps*
- 19 Thoracic squama waxy white. Eyes in male without any abrupt change in facet size *Chrysomya bezziana*
- Thoracic squama dark grey. Eyes in male with large facets on upper three fifths of their height and very small facets below, the transition abrupt *Chrysomya megacephala*
- 20 Proboscis of unusual build, short and very heavily developed. Large dull brown flies *Bengalia peuhi*
- Proboscis not unusual in structure. Large blue-black flies resembling *Calliphora*, but with apex of abdomen yellow *Pericallimyia greatheadi*

Family Calliphoridae

Subfamily Rhiniinae

Genus *Cosmina* Robineau-Desvoidy, 1830*Cosmina* Robineau-Desvoidy, 1830. — Essai Myod. 2: 423.

Type species: *Cosmina fuscipennis* Robineau-Desvoidy, 1830 by designation of TOWNSEND (1916: 6).

Cosmina fuscipennis Robineau-Desvoidy, 1830*Cosmina fuscipennis* Robineau-Desvoidy, 1830. — Essai Myod. 2: 423.

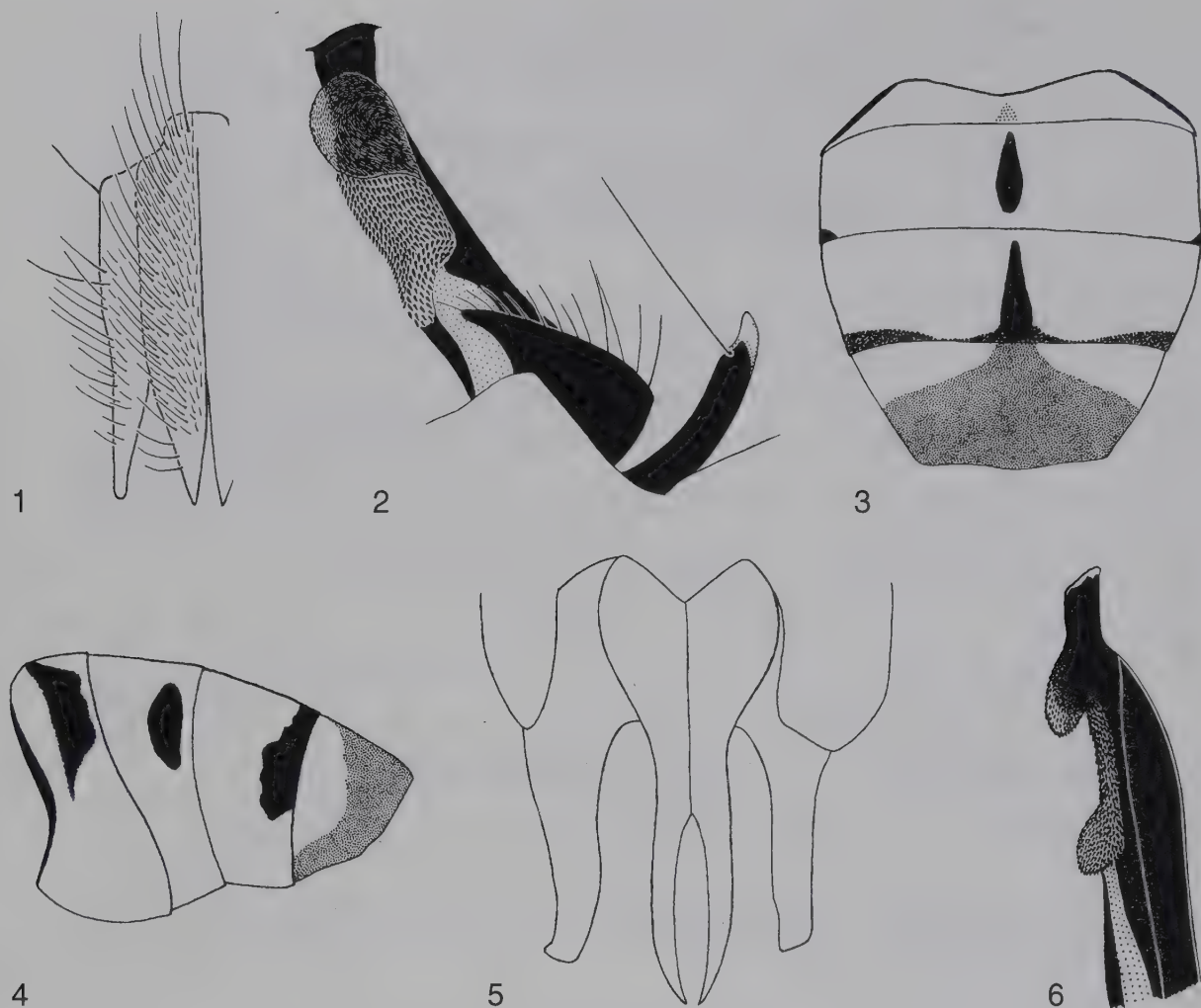
Material: Oman: 1 ♀, Dhofar, Hagayf, 17°14'N 54°03'E, 6.IX.1989, M.J. Ebejer, MJEC.

Described from South Africa and recorded as being widespread in southern and eastern Africa and Madagascar.

Cosmina arabica Robineau-Desvoidy, 1830*Cosmina arabica* Robineau-Desvoidy, 1830. — Essai Myod. 2: 424.

Material: Oman: 1 ♀, Sharqiya, Fins, 22.II.1990, M.J. Ebejer. — Yemen: 1 ♂, Al Kowd, Malaise trap, 15-28.II.1993, A. van Harten; 1 ♀, same data but IV.1993; all NMWC.

Described from "Arabie" and further recorded from Palestine, this is an uncommon species.



Figs 1-6: 1-2, *Cosmina ebejeri* n. sp., ♂: 1, cercus and surstylus; 2, aedeagus and gonites in profile. 3-6, *Rhyncomya io*, ♂: 3, abdomen from above; 4, abdomen in profile; 5, outline of cerci and surstyli; 6, aedeagus (base obscured) in posterolateral view.

Cosmina ebejeri n. sp. (Figs 1-2)

Holotype: ♂, Oman, Wadi al Khoud, 22.X.1988, M.J. Ebejer, NMWC. — Paratypes: Oman: 4 ♀♀, same data and deposition; 1 ♂, 1 ♀, Fanja, 6.I.1989, M.J. Ebejer, NMWC; 2 ♂♂ (poor condition), Eastern Sands, Mintirib, Res. Camp, 22°25'N 58°49'E, 269 m, 18-28.III.1986, W. Büttiker, NHMB.

Description: A black species, yellow on parafacialia with the exception of a large black shining spot at level of vibrissa, on interfrontalia, lunula, antenna, upper half of face, on base and extreme apex of palpus and the entire haltere; lower eye margin, front of jowl, knees, tibiae, tarsi, anterior spiracle and pleural sutures obscurely yellow; wing faintly brownish hyaline with base, including basicosta, distinctly yellowish and veins, especially on basal half, yellowish and squamae yellowish white. Dusting heavily silvery grey on parafrontalia, parafacialia and postorbits and less heavily so on face, weakly darker grey dusted on ocellar prominence, occiput, mesonotum, scutellum, metanotum, legs and abdomen, the pleura subshining greenish through very weak dusting. Setae predominantly black, but clothing setae of humerus, prosternum, most of the pleura and on underside of scutellum silvery white. Mesonotum and scutellum with small subshining spots at the bases of setae and dorsum of tergites with similar, but minute, spots.

Table 1: A comparison of the diagnostic characters of *Cosmina arabica* Robineau-Desvoidy and *C. ebejeri* n. sp.

| | <i>Cosmina arabica</i> | <i>Cosmina ebejeri</i> |
|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|
| σ | | |
| 1. | eye facets on lower two fifths of eye distinctly smaller than those above, especially the forwardly-facing facets | no such abrupt division in eye field |
| 2. | frons at narrowest point no wider than half diameter of anterior ocellus | frons at narrowest point 1.5 times as wide as diameter of anterior ocellus |
| 3. | wing with distinct dark fumose costal band (more evident in σ than in η) | costal area not noticeably darker than remainder of wing membrane |
| 4. | mid tibia with well-developed anteroventral bristle just proximal of the anterodorsal | mid tibia lacking anteroventral bristle (present in η) |
| 5. | sternite 2 compactly white-haired and bearing about ten long fine bristles, which are black and at least twice as long as the white hairs | sternite 2 with short pale hairs only on anterior third, the remainder of the sternite with compact long black hairs |
| 6. | surstylus band-shaped, apically truncate, of almost equal width throughout its length | surstylus tapering throughout its length |
| η | | |
| 7. | polished spots at bases of parafrontal setae larger, on anterior one third of frons the diameter of these greater than the width of the interspaces | these smaller, on anterior one third of frons the interspaces wider for the most part than the spots they enclose |

Male: Head in profile no more prominent at epistoma than at base of antenna; fronto-facial angle about 135° ; anterior margin of jowl with an uninterrupted row of six bristles extending from vibrissa to mouth-margin; arista with minute rays on apical third; palpus as deep as width of parafrontalia at level of antennal insertion. Mesonotum and scutellum with rather long setae; propleuron bare; notopleuron with minute dark setae in addition to the two bristles; posterior sternopleural bristle 1.5 times as long as the anterior; wing with cell r 5 open; thoracic squama twice as long as the alar, broadest at mid-length and with margin evenly rounded; tergites 3-5 equal in length, 1 + 2 slightly shorter and with medial excavation not extending to hind margin; sternite 2 bearing compact black hairs that are as long as the lobes of sternite 5, these lobes with margins evenly rounded and lacking strong setae; cercus and surstylus (Fig. 1) with their apices somewhat curved forward; aedeagus and gonites as in Fig. 2. Length about 7.5 mm, of wing 6 mm.

Female: differing from male in the usual ways, in possessing an anteroventral bristle on the fore tibia and in having the interfrontalia at level of lunula one half of the parafrontal width.

Affinities: The lesser depth of the palpus in both sexes immediately distinguishes this species and *C. arabica* from the African species *C. undulata* (Malloch). The taxonomic characters used to distinguish *C. ebejeri* from *C. arabica* are given in Table 1.

Cosmina viridis (Townsend, 1917)

Synamphoneuropis viridis Townsend, 1917. — Rec. Indian Mus. 13: 199.

Material: Oman: 1 η , Dhofar, Sarfait, J. Qamr, $16^\circ 42'N$ $53^\circ 07'E$, 1330 m, 9.IX.1989, M.D. Gallagher; 3 η , Dhofar, Wadi Nahiz, 6.IX.1989, M.J. Ebejer. — Yemen: 1 η , Mahwit, 7.VI.1991, A. van Harten; 1 σ , Sana'a, III-IV.1992, A. van Harten; 1 σ , same data but date 1992; all NMWC.

Described as the type species of Townsend's new genus *Synamphoneuropsis* (a synonym of *Cosmina*) from India, this species has been recorded from Ethiopia, 'French Equatorial Africa', 'South Yemen', Arabia and Iran. All the females in this material are more blue than green in colour.

Genus *Isomyia* Walker, 1859

Isomyia Walker, 1859. — J. Proc. Linn. Soc. Lond.: 134 (as subgenus of *Musca*).

Type species: *Musca delectans* Walker, 1859 by original designation and monotypy.

Isomyia terminata (Wiedemann, 1830)

Musca terminata Wiedemann, 1830. — Aussereurop. zweifl. Insekt. 2: 414.

Material: Oman: 2 ♂♂, 1 ♀, Dhofar, Mughsail, 16°50'N 53°41'E, 4.IX.1989, M.J. Ebejer; 5 ♀♀, Dhofar, Wadi Nahiz, 6.IX.1989, M.J. Ebejer; all NMWC apart from 1 ♂, 3 ♀♀, MJEC.

Described from Sierra Leone and recorded as being widespread from West Africa to the Congo Basin and also occurring in Uganda.

Genus *Pararhyncomyia* Becker, 1910

Pararhyncomyia Becker, 1910. — Denkschr. Kais. Akad. Wiss. Wien 71: 142.

Type species: *Pararhyncomyia cribriformis* Becker, 1910 by monotypy.

Pararhyncomyia cribriformis Becker, 1910

Pararhyncomyia cribriformis Becker 1910. — Denkschr. Kais. Akad. Wiss. Wien 71:143.

Material: Oman: 1 ♀, Dhofar, Ain Rezaat, 13.II.1989, M.J. Ebejer, MJEC.

Described from Socotra, recorded positively from Tanzania and tentatively from Kenya.

Genus *Rhyncomyia* Robineau-Desvoidy, 1830

Rhyncomyia Robineau-Desvoidy, 1830. — Essai Myod. 2: 424.

Type species: *Musca felina* Fabricius, 1794 by monotypy.

Various variant spellings of *Rhyncomyia* have been used in the description and recording of species, and are *Rhynchomyia*, *Rhynchomya* and *Rhyncomyia*.

Rhyncomyia io (Peris, 1951) (Figs 3-6)

Rhynchomyia io Peris, 1951. — Eos 27 (2): 244.

Material: Oman: 1 ♂, Yalooni, 19°56'N 57°05'E, 154 m, 14.III.1994, M.D. Gallagher, NMWC.

Described from two females from Kenya and not since recorded. Differences between this male and the female paratype are given in Table 2.

Male abdomen as in Figs 3-4; sternite 5 dull, pollinose, black with only the apicolateral parts of the lobes yellow, the lobes rather narrow and evenly rounded on inner margins and bearing setulae that are no different from the surrounding ones on the ventrally-facing parts of tergites; epandrium and tergite preceding it all dull black; cerci and surstyli (Fig. 5) dull black with rather long fine dark sinuous hairs; aedeagus (Fig. 6) constricted preapically, the posterior surface concave, laterally with two pairs of spiculate membranous lobes.

Rhyncomyia bullata n. sp. (Figs 7-12)

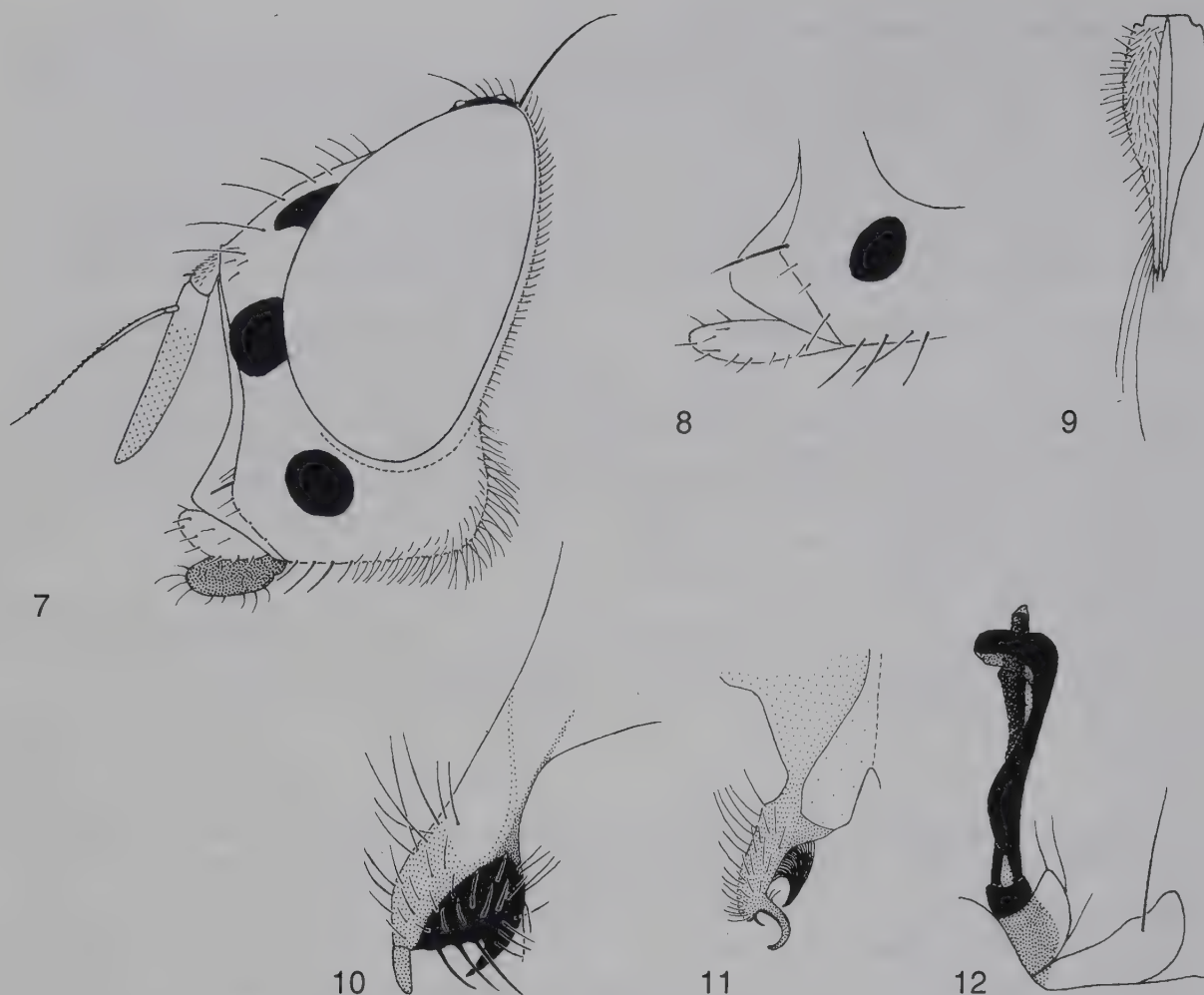
Holotype: ♂, Oman, Muscat, Baushar, boulder-strewn dry chasm, 14.XI.1992, J.C. Deeming. — Paratypes: Oman: 1 ♀, East Coast, Fins, on dune vegetation, 13.XI.1992, M.D. Gallagher & J.C. Deeming; 2 ♂♂, Northern Region, 17 km NW of Ibra, 22°50'N 58°23'E, 30.XII.1994, B. Skule; all NMWC.

Table 2: Comparison of the sexes of *Rhyncomya io* Peris

| | ♂ from Yalooni | ♀ paratype from Ziwani |
|----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|
| 1. | frons at narrowest point 1.5 times as broad as anterior ocellus | frons narrowest at vertex, where slightly wider than distance separating vibrissae |
| 2. | external vertical bristle undeveloped | external and internal vertical bristles equally developed |
| 3. | prevertical and orbital bristles absent | reclinate prevertical and about seven proclinate orbital bristles present |
| 4. | upper two thirds of occiput black throughout | a trapezoid yellow marking on upper occiput having its longest side extending between the internal vertical bristles |
| 5. | basal three quarters of fore tibia, whole of mid tibia and extreme base of hind tibia brown, coxae black | legs black throughout (but both mid legs missing from specimen), but all coxae dirty yellow |
| 6. | median vitta on tergites 3 and 4 not extending to margins, the apical dark band on tergite 3 restricted to lateral surface, that on tergite 4 extending two thirds of the way to median vitta, that of tergite 5 complete but obscured dorsally by thick grey dusting | median dark vitta of tergites unbroken and connected to apical dark bands on tergites 3-5 |
| 7. | underside of tergites 2 and 3 predominantly white setose, those of 4 and 5 black setose | underside of tergite 2 predominantly white setose, those of 3-5 black setose |
| 8. | ground colour of tergites cream white | ground colour of tergites dirty yellow |

Description: Male: A predominantly yellow species, shining black on three pairs of bullate spots on the head, being on the parafrontalia, parafacialia and jowls respectively, on sclerites of proboscis, on upper half of occiput with the exception of a W-shaped postvertical emargination, on entire tergite 6 and basal half of sternite 5, in a line of markings laterally on tergites, being a round spot on apex of tergite 2, a long quadrate marking occupying apical three fifths of tergite 3, a similar one occupying all but extreme base of tergite 4 and another occupying apical half of tergite 5, black and moderately greenish grey dusted on ocellar prominence, on all sclerites of thorax, but mesonotum and scutellum with weaker dusted points at bases of bristles, brown on a faint median line on tergites 3 and 4, on the apical four segments of all tarsi, on fore margin of wing and suffusedly over wing tip, on apical half of arista and faintly on apical three quarters of third antennal segment; legs faintly yellow-grey dusted; parafrontalia and parafacialia silver dusted, except on shining spots; all bristles black, but clothing hairs of lower occiput and jowls, postero-dorsal surface of stem vein, squamal fringes, underside of scutellum, pleura, prosternum and underside of tergite 2 silvery white; wing hyaline with brown veins, but stem vein and extreme base of costa yellow; squamae cream-white.

Head (Fig. 7): frons at narrowest point slightly wider than diameter of anterior ocellus; propleuron bare; one long and one short posterior intra-alar bristle; mesopleuron with a row of four strong posterior bristles, the most dorsally-situated of which is the weakest, this situated in the extreme upper hind corner of the sclerite and preceded by a row of five short upwardly-curved black setae; sternopleuron with the more anterior of the two upper bristles weaker and shorter than the posterior; fore tibia with three short anterodorsal bristles; mid tibia with one anterodorsal, one posterodorsal and three posterior bristles; hind tibia with three anterodorsal and three postero-dorsal bristles; wing cell r 5 open; bend of vein M rounded; thoracic squama elongate oval, with evenly rounded apical margin widely separated from scutellum and twice as long as alar squama; anal cleft narrow, extending full length of epandrium; surstyli (Figs 10-11) fused to epandrium,



Figs 7-12: *Rhyncomya bullata* n. sp.: 7, ♂, head in profile; 8, ♀, vibrissal angle in profile; 9, ♂, cerci; 10, ♂, right surstylus, outer surface; 11, ♂, left surstylus in ventral view; 12, ♂, aedeagus and gonites in profile.

each bearing an apical hook and compact hook-like hair bunch preapically; cerci as in Fig. 9; epandrium and gonites as in Fig. 12. Length about 6.0 mm, of wing 4.5 mm (holotype), these measurements 7.0 and 6.0 respectively in the two male paratypes.

Female: differing from male in the following respects: mouth-margin (Fig. 8) more prominent in profile; four bullate spots on head, two of these being on parafrontalia; three orbital, one prevertical and both vertical bristles developed; frons one third of width of head, the interfrontalia at mid length slightly narrower than the parafrontalia; fore tibia with additional posteroventral bristle; mid tibia with additional ventral bristle and only two posteriors; hind tibia with additional anteroventral bristle; medial tergal line darker and encroaching on apex of tergite 2. Length: 7 mm, of wing 5.2 mm.

Affinities: This species is immediately separable from other described species by having the surstyli fused to the epandrium and bearing peculiar chaetotaxy. In the keys of PERIS (1952: 199) and ZUMPT (1958: 127) it would run to *R. varifrons* Becker, 1910, differing from it in not having the bend of vein M angulate. ZUMPT's (1958: 178) photographs of the male genitalia of a paratype of *R. varifrons* show the cerci to be extremely short, the surstyli lacking specialised chaetotaxy and clearly discrete from the epandrium and the aedeagus of a different structure.

Rhyncomya sp.

Material: Oman: 2 ♀♀, Yalooni, 19°56'N 57°06'E, 1.XII.1992, A.J. Spalton, NMWC.

These two females are very similar to that of the previously described species (*R. bullata*), differing from it in having the head bullae smaller and in only three pairs, the humerus completely and the scutellum predominantly of a yellow ground colour, the extreme apices of fore and hind tibiae tinged with black, the thorax more heavily grey dusted, and the costal margin only faintly suffused with brown. These I believe to represent an undescribed species, but would not describe such on female material alone.

Rhyncomya flavipes (Séguy, 1933)

Rhyncomyia callopis var. *flavipes* Séguy, 1933. — Mem. Estud. Mus. zool. Univ. Coimbra 67: 70.

Rhyncomya flavipes. — Zumpt & Tsacas 1976; J. nat. Hist. 10: 347 (new status, designation of lectotype, diagnosis and synonymy).

Material: Oman: 5 ♂♂, Bowsher dunes, 26.II.1988, M.J. Ebejer; 2 ♀♀, Baushar, 18.IV.1988, M.D. Gallagher; 1 ♀, Al-Seefa, coastal sand dunes, 4.XII.1987, M.J. Ebejer; 1 ♀, Wadi Ma'awil, inland dunes, 26.XII.1989, M.J. Ebejer; 1 ♀, Muscat, Al Khuwair, IV.1990, R. Matthai; 1 ♂, 2 ♀♀, Al Khuwair, on chenopods at head of beach, 3.XII.1992, J.C. Deeming; 2 ♂♂, 4 ♀♀, Muscat, coastal dunes near Ghubrah, 30.X.1990, M.D. Gallagher & J.C. Deeming; all NMWC; 1 ♀, Seeb, coastal dunes, 6.XI.1987, M.J. Ebejer; 1 ♂, Ras al Junayz, 12.XI.1987, M.J. Ebejer; 1 ♂, 1 ♀, Ras al Hamra, 21.XII.1987, M.J. Ebejer; 1 ♂, Seeb Airport beach, 8.III.1990, M.J. Ebejer; 2 ♀♀, Wahiba Sands, 5.XII.1990, M.J. Ebejer; all MJEC; 1 ♂, 2 ♀♀, Madinat Qaboos, 23°35'N 58°28'E, on dunes after rain, 24.II.1982, M.D. Gallagher; 4 ♀♀, same locality and collector, on dunes at m.v. light, 5.V.1982; all BMNH; 1 ♂, 1 ♀, Wahiba Sands SE of Al Wasil, 22°26'N 58°45'E, on *Calligonum comosum*, 25.X.1990, M.D. Gallagher & J.C. Deeming; 2 ♀♀, Wahiba Sands, 22°22'N 58°52'E, at light, dune hollow, 3.X.1994, M.D. Gallagher & G. Lowe; 1 ♂, 2 ♀♀, Wahiba Sands, 21°50'N 59°19'E, *Prosopis* woodland on dunes, at light, 20.XII.1994, B. Skule & M.D. Gallagher; all NMWC; 1 ♂, 1 ♀, Eastern Sands, Wadi Andam, 21°50'N 58°18'E, 5.III.1986, M.D. Gallagher; 1 ♂, Wadi Andam, 21°07'N 58°27'E, 1.II.1986, M.D. Gallagher; all NHMB; 2 ♂♂, 22 km W of Tanam, 23°09'N 56°15'E, 250 m, light trap on gravel plain with blown sand, *Acacia* and *Rhazya* scrub, 29.III.1994, M.D. Gallagher & B. Tigar; 1 ♂ Ramlat al Zummayin, 20°49'N 57°14'E, 13.III.1994, M.D. Gallagher; all ONHM.

Described as *Rhyncomyia callopis* var. *flavipes* from Niger, Mauritania, Tunisia and Rio de Oro, a lectotype has been selected from a mixed syntype series by ZUMPT & TSACAS (1976: 347), who placed the name *R. flavipes* as a senior synonym of the well-known *R. desertica* Peris, 1951: 243. It is further known from Algeria, Chad, Libya, Egypt, Palestine and Saudi Arabia. The male from the Wahiba Sands collected on 25.X.1990 has the posterior sclerotised tongue of the aedeagus shorter and broader and the surstylus somewhat shorter-haired than in the rest of the material. Mr. N.P. Wyatt has kindly examined this specimen and considers that these differences may be attributed to natural variation within the species.

Rhyncomya nigripes (Séguy, 1933)

Rhyncomyia callopis var. *nigripes* Séguy, 1933. — Mem. Estud. Mus. zool. Univ. Coimbra 67: 71.

Rhyncomya nigripes. — Zumpt & Tsacas 1976; J. nat. Hist. 10: 347 (new status, designation of lectotype, diagnosis and synonymy).

Material: Oman: 1 ♂, 4 ♀♀, Eastern Sands, Ras Dhabdhub, Camp, 21°32'N 58°49'E, 180 m, 22-25.I.1986, W. Büttiker; 2 ♂♂, Eastern Sands, Mintirib, Res. Camp, 22°25'N 58°49'E, 269 m, 19-28.I.1986, W. Büttiker; all NHMB; 1 ♂, same data but 12-28.II.1986, NMWC; 3 ♂♂, 8 ♀♀, same data, NHMB; 2 ♂♂, Wahiba Sands, near Wadi Andam, 21°07'N 58°27'E, 1.II.1986, M.D. Gallagher, NHMB; 1 ♂, Dhofar, Salalah, Khor Salalah, feeding at flowers of *Limonium axillare* (Plumbaginaceae), 11.XI.1992, J.C. Deeming, NMWC; 1 ♂, 4 ♀♀, Yalooni, Jiddat al Harasis, 19°56'N 57°05'E, 154 m, 13.III.1994, M.D. Gallagher, NMWC and ONHM; 1 ♂, 1 ♀, Wadi Batha, 22°08'N 59°15'E, 90 m, vegetation on wadi bank, 29.XII.1994, B. Skule, NMWC.

Described as *Rhyncomyia callopis* var. *nigripes*, Zumpt & Tsacas have designated as lectotype a male from Tunisia and place the species as a senior synonym of *R. minima* (Peris, 1951: 243), known also from Morocco, Mauritania, Algeria, Palestine, Iraq and Iran.

Rhyncomya jordanensis (Peris, 1951)

Rhyncomyia jordanensis Peris, 1951. — Eos 27: 242.

Material: Oman: 1 ♂, Yalooni, 19°57'N 57°06'E, stony plateau with *Acacia* spp., grasses, camels and oryx, 170 m, 13.I.1988, M.D. Gallagher, NMWC; 1 ♂, Fanjah, Wadi Fanjah, 23°27'N 58°08'E, 9.IV.1985, C. Holzschuh, NHMB; 1 ♂, Jebel Shams, 2200 m, 1.VI.1990, M.J. Ebejer, MJEC; 1 ♀, Dhofar, Hagayf, 17°14'N 54°03'E, 12.X.1990, M.J. Ebejer, MJEC. — Yemen: 2 ♀♀, Al Kowd, Malaise trap, 15-28.II.1993, A. van Harten, NMWC.

Described from Baluchistan and Palestine.

Genus *Villeneuveiella* Austen, 1914

Villeneuveiella Austen, 1914. — Nov. Zool. 21: 272.

Type species: *Villeneuveiella harterti* Austen, 1914 by original designation.

PONT (1980: 784) placed the genus *Villeneuveiella* in synonymy with *Rhyncomya*. This is not accepted by SCHUMANN (1986: 57). When in doubt as to such relationships a study of immature stages is often revealing. FERRAR (1987: 600) presents a cephalopharyngeal skeleton figure of the third instar larva of *Rhyncomya noiroti* (Séguy), which shows the pharyngeal sclerite to be much enlarged and of a most unusual ragged outline. His figures (loc. cit.: 584-585) of first instar larvae of two species of *Villeneuveiella* show the abdominal segments to bear peculiar lateral setal tufts. Until such time as third instar larvae of a *Villeneuveiella* species are available for purposes of comparison I would not accept the two genera being treated as synonymous.

Villeneuveiella seguyi Grunin, 1957

Villeneuveiella seguyi Grunin, 1957. — Ent. Obozr. 36: 543.

Material: Oman: 4 ♀♀, Yalooni, 19°57'N 57°06'E, stony plateau with *Acacia* spp., camels and oryx, 170 m, 13.I.1988, M.D. Gallagher, NMWC; 6 ♀♀, same data, MJEC; 3 ♀♀, Yalooni, 16-17.XII.1991, M.D. Gallagher, NMWC; 3 ♀♀, Yalooni, 154 m, 14.III.1994, M.D. Gallagher, ONHM; 1 ♀, Yalooni, Jiddat al Harasis, 19°57'N 57°07'E, to m.v. light, 21.IV.1982, M.D. Gallagher, BMNH; 2 ♀♀, Wadi Ghul, 23°14'N 57°09'E, 1450 m, at m.v. light, 1.XI.1990, M.D. Gallagher & J.C. Deeming; 2 ♀♀, Muscat, Bandar al Jissah, at m.v. light, 29.X.1990, M.D. Gallagher & J.C. Deeming; 1 ♀, same data, 10.XII.1992; all NMWC.

Known from Iran, Yemen and Saudi Arabia.

Genus *Rhinia* Robineau-Desvoidy, 1830

Rhinia Robineau-Desvoidy, 1830. — Essai Myod. 2: 422.

Type species: *Rhinia testacea* Robineau-Desvoidy, 1830 (= *Idia apicalis* Wiedemann, 1830) by monotypy.

Rhinia apicalis (Wiedemann, 1830)

Idia apicalis Wiedemann, 1830. — Aussereurop. zweifl. Insekt. 2: 354.

Material: Oman: 1 ♀, Dhofar, Wadi Nahiz, 21-25.IX.1988, M.J. Ebejer, NMWC; 5 ♂♂, Al Khiran, Yitti, 11.III.1988, M.J. Ebejer, MJEC; 1 ♀, Al Qabil, 24.II.1990, M.J. Ebejer, MJEC; 1 ♂, Eastern Sands, Mintirib, 22°25'N 58°49'E, 12-28.II.1986, W. Büttiker, NHMB.

A common species that is widespread throughout the tropics and subtropics of the Old World. Seven synonyms are listed in PONT (1980: 784).

Genus *Stomorbina* Rondani, 1861

Stomorbina Rondani, 1861. — Dipt. ital. prodr. 4: 9. (replacement name for *Idia* Wiedemann, 1820).

Type species: *Musca lunata* Fabricius, 1805 by designation of TOWNSEND (1916: 7).

Stomorhina cribrata (Bigot, 1874)

Rhinia cribrata Bigot, 1874. — Anns Soc. ent. Fr. 4: 239.

Material: Oman: 2 ♂♂, Muscat, Wadi Adai, 18.XII.1987, M.J. Ebejer, MJEC; 1 ♂, same data, NMWC; 1 ♂, 1 ♀, Jebel Akhdar, Ghubra Bowl, 15.XI.1989, M.J. Ebejer; 3 ♂♂, 1 ♀, Jebel Akhdar, Wadi Mistal, 15.XI.1989, M.J. Ebejer; all MJEC; 2 ♂♂, Wadi Bani Kharus, Istal, 19.XI.1992, M.D. Gallagher & J.C. Deeming, NMWC; 1 ♂, Al Hamrah, Dat Kale, hovering in lime grove, 18.XI.1992, J.C. Deeming, NMWC.

Widespread in the Afrotropical Region, this species is also known from Palestine and Iran. PONT (1980: 786) lists two synonyms.

Subfamily Chrysomyinae

Genus *Chrysomya* Robineau-Desvoidy, 1830: 44.

Chrysomya Robineau-Desvoidy, 1830. — Essai Myod. 2: 44.

Type species: *Chrysomya regalis* Robineau-Desvoidy, 1830 by designation of COQUILLET (1910: 523). PONT (1980: 788) lists the emendation *Chrysomyia* Agassiz, 1847 as being unjustified.

Chrysomya albiceps (Wiedemann, 1819)

Musca albiceps Wiedemann, 1819. — Zool. Mag. Kiel 1 (3): 38.

Material: Oman: 3 ♂♂, 2 ♀♀, Muscat, 5.III.1988, M.J. Ebejer, MJEC; 6 ♂♂, 6 ♀♀, same data, NMWC; 3 ♂♂, Muscat, 9.I.1988, M.J. Ebejer, MJEC; 2 ♂♂, same data, NMWC; 2 ♀♀, Ras al Junayz, 12.XI.1987, M.J. Ebejer, MJEC; 1 ♂, Wahiba Sands, 21°38'N 59°18'E, on dung, 26.III.1986, M.D. Gallagher, NHMB; 1 ♀, Eastern Sands, Mintirib, Res. Camp, 22°25'N 58°49'E, 269 m, 19-28.I.1986, W. Büttiker, NHMB; 1 ♂, Yalooni, Jiddat al Harasis, 19°56'N 57°05'E, 154 m, 13.III.1994, M.D. Gallagher, ONHM; 1 ♀, Dhofar, Marmul, Desert Agric. Project, XI.1992, J.C. Deeming, NMWC; 1 ♀, Wadi Batha, 22°06'N 59°15'E, wet wadi with *Tamarix*, 29.XII.1994, B. Skule, NMWC. — United Arab Emirates: 1 ♀, Abu Dhabi, Ruwais, 30.XII.1985, M.J. Ebejer, NMWC.

Native to Africa, extending eastwards to NW India and the Indian Ocean and introduced and established in Brazil, eleven synonyms are listed by PONT (1980: 788) for this common species.

Chrysomya bezziana (Villeneuve, 1914)

Chrysomyia bezziana Villeneuve, 1914. — Revue Zool. Bot. afr. 3: 430.

Material: Oman: 1 ♂, 1 ♀, Muscat, reared from human leg ulcer, 27.II.1990, M.J. Ebejer, MJEC.

Widespread in the Afrotropical and Oriental Regions, this species is the only one of the genus that is an obligatory parasite of wounds in man and his domesticated mammals, whereas another nine species normally breed in decomposing organic matter, but may become facultative wound parasites (ZUMPT 1965: 89).

Chrysomya megacephala (Fabricius, 1794)

Musca megacephala Fabricius, 1794. — Syst. Ent. 4: 317.

Material: Oman: 1 ♂, Barka, 30.X.1987, M.J. Ebejer, MJEC; 1 ♂, Wadi Abyad, 16.III.1990, M.J. Ebejer, MJEC; 2 ♀♀, same data but 30.III.1990, one MJEC and one NMWC.

Distributed throughout the tropics of the Old World and introduced and established in Brazil; PONT (1980: 789) lists three synonyms for this common species.

Chrysomya regalis Robineau-Desvoidy, 1830

Chrysomya regalis Robineau-Desvoidy, 1830. — Essai Myod. 2: 449.

Material: Oman: 5 ♂♂, 3 ♀♀, Muscat, 5.III.1988, M.J. Ebejer, MJEC; 8 ♂♂, 7 ♀♀, same data, NMWC; 1 ♂, Muscat, Wadi Hatat, 18.XII.1987, M.J. Ebejer, MJEC; 1 ♀, Jebel Akhdar, Wadi Mistal, 9.IX.1988, M.J. Ebejer, MJEC; 1 ♀,

Dhofar, Salalah, 44°06'N 17°03'E, 2.IX.1989, M.J. Ebejer, MJEC; 1 ♂, Al Hajar Asharqi, Ain Hamudah, 22°34'N 50°05'E, 600 m, 26.X.1990, M.D. Gallagher & J.C. Deeming, NMWC; 1 ♂, Yiti, 23°31'N 58°38'E, cultivation, 20.III.1992, M.D. Gallagher, NMWC; 4 ♀♀, Wahiba Sands, 21°38'N 59°18'E, on dung, 26.III.1986, M.D. Gallagher, NHMB; 3 ♂♂, 1 ♀, Wadi Batha, 22°06'N 59°15'E, wet wadi with *Tamarix*, 29.XII.1994, B. Skule, NMWC; 1 ♀, Wadi Abyadh, 23°25'N 57°40'E, 230 m, at light on hills and vegetation bordering gravel wadi, 21.XII.1994, M.D. Gallagher & B. Skule, ONHM.

Widespread in the Afrotropical Region and extending eastwards to Pakistan; PONT (1980: 789) lists three synonyms of this common species.

Subfamily Calliphorinae

Genus *Bengalia* Robineau-Desvoidy, 1830

Bengalia Robineau-Desvoidy, 1830. — Essai Myod. 2: 425.

Type species: *Bengalia labiata* Robineau-Desvoidy, 1830 by designation of TOWNSEND (1916: 6).

Bengalia peuhi Villeneuve, 1914

Bengalia peuhi Villeneuve, 1914. — Rev. Zool. Bot. afr. 3: 253.

Material: Oman: 1 ♂, Dhofar, Khor Rouri, 15.VII.1989, M.J. Ebejer, MJEC; 1 ♀, Dhofar, Salalah, 2.IX.1989, M.J. Ebejer, MJEC; 1 ♀, Dhofar, Hagayf, 17°14'N 54°03'E, 6.IX.1989, M.J. Ebejer, MJEC; 1 ♀, Wadi Darbaat, 13.X.1990, J.C. Deeming, ONHM.

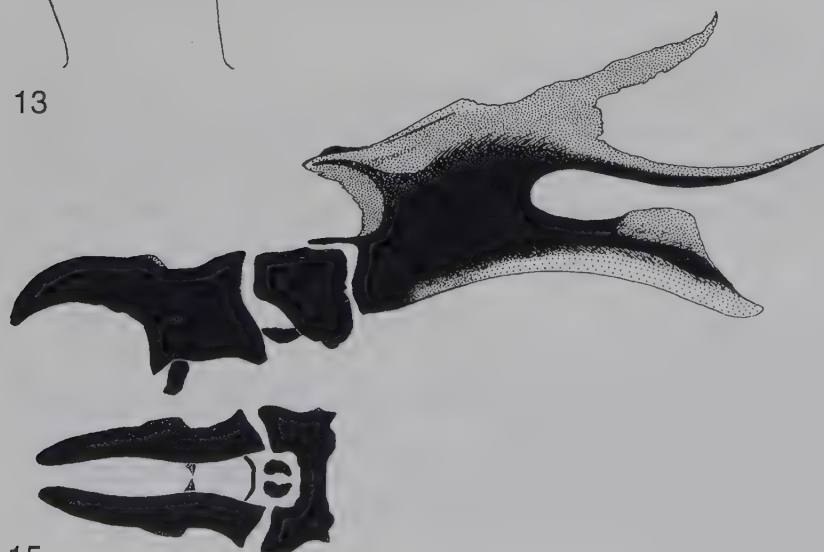
A common species, widespread in the Afrotropical Region, including Madagascar; PONT (1980: 791) lists a synonym.



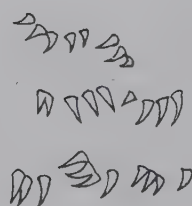
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14



15



16

Figs 13-16: *Pericallimyia greatheadii*, pupa: 13, anterior spiracle; 14, left posterior spiracle; 15, larval cephalopharyngeal skeleton in profile and mandibular and hypostomal sclerites from above; 16, spicules on larval cephalic integument adjoining buccal cavity.

Genus *Pericallimya* Villeneuve, 1915*Pericallimya* Villeneuve, 1915. — Bull. Soc. ent. Fr. 1915: 266.Type species: *Pericallimya marginalis* Villeneuve, 1915 by designation of CURRAN (1926: 47).*Pericallimya greatheadi* Zumpt, 1971 (Figs 13-16)*Pericallimya greatheadi* Zumpt, 1971. — Novos Taxa ent. 99: 3.Material: Oman: 2 ♂♂, 1 ♀, Dhofar, Hagayf, 17°14'N 54°03'E, 6.IX.1989, M.J. Ebejer, MJEC; 1 ♂, 2 ♀♀, with individual puparia, 1 dead pupa and shells of hosts, Dhofar, Wadi Darbaat, ex larvae coll. 13.X.1990 ex shells of the tree-snail *Euryptyxis latireflexa* (Reeve) in congregation on trunks of *Ficus sycamora*, M.J. Ebejer & J.C. Deeming, NMWC. — Yemen: 2 ♂♂, Sana'a, II.1992, A. van Harten, NMWC.

The identification of the snails was based upon additional specimens having their soft parts intact.

Description of puparium: blackish brown, subshining, 10.0 mm in length, 4.8 mm in greatest width, ovoid and without projections; anterior spiracles (Fig. 13) small with long axis longitudinal; posterior spiracles (Fig. 14) with their bases in slight depressions and separated from one another by slightly less than an individual width; anal plate small, triangular, deeply cleft medially and with its base at the anterior end of the cleft; cephalopharyngeal skeleton (Fig. 15) with dorsal wing of pharyngeal sclerite deeply divided; larval cephalic integument adjoining buccal cavity (Fig. 16) with irregular broken rows of pointed tusk-like spicules.

Described from Ethiopia.

ADDENDA

Upon completion of this study two further specimens from the Büttiker Collection were discovered in the unidentified accession material of the BMNH. Although not from Oman, they are treated here.

Rhyncomya callopis (Loew, 1856)*Idia callopis* Loew, 1856. — Programm K. Realschule zu Meseritz 1856: 49.

Material: Saudi Arabia: 1 ♂ (lacking both fore legs), Wadi Mizbil, 13.IV.1977, W. Büttiker, BMNH.

Described from Egypt and known also from Palestine, Turkmenia, Iran, Tunisia, Algeria and Morocco, the male of this species is distinctive in having very heavily developed chaetotaxy on the surstylus.

Rhyncomya sp. ? *peusi* (Zumpt, 1956)*Rhynchomyia peusi* Zumpt, 1956. — 64i. Calliphorinae, Fliegen pal. Reg. 8: 105.

Material: Saudi Arabia: 1 ♂, Kushm al Buwaybiyat, 26.V.1978, W. Büttiker, BMNH.

Described from the Greek Islands into this genus, but using the variant spelling *Rhyncomyia*, this species is also known from Albania, Cyprus, Crete, Romania, the Black Sea region and Turkey. This specimen differs from the diagnosis of the species in possessing only a single pair of shining black spots on the head, these being in diameter one half of the width of the parafacialia and in contact with the eye at one third of its height. The anal cerci differ from all those figured for this species (ZUMPT 1956: 106 of type material; LEHRER 1964: 505; GONZÁLEZ-MORA & PERIS 1988: 110) in having the male anal cerci abruptly separated at their point of division and thereafter lying parallel to one another, the cleft between an open-ended rectangle.

ACKNOWLEDGEMENTS

I am most grateful to Prof. W. Büttiker for making his material available to me; to the Ministry of National Heritage and Culture and the Ministry of Agriculture and Fisheries of Oman and British Council for sponsoring and organising my two visits; to Dr. M.J. Ebejer (Balzan, Malta) and Mr. M.D. Gallagher (Muscat) for making their collections available to me, for taking me collecting in various parts of Oman and for accommodating me; to Mr. A. van Harten (Suva) for the gift of his Yemen material; to Mr. N.P. Wyatt, (BMNH) for his kind advice, for his identification of the material reared from snails and for the loan of a paratype; to Dr. M. Seddon (NMWC) for the identification of the snails and to the Director, NMWC for research facilities.

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Chyromyidae (Diptera: Schizophora) from the Arabian Peninsula with Descriptions of New Species

Martin J. Ebejer

Abstract: A first account is given of the family Chyromyidae from the Arabian Peninsula. Thirteen species of *Aphaniosoma* are recorded, of which seven are newly described: *A. arabicum*, *A. brunnipes*, *A. deemingi*, *A. dhofaricum*, *A. gallagheri*, *A. harteni* and *A. yittii*; two species each of *Somatiosoma* and of *Gymnochiromyia* are also recorded with *G. punctata* newly described. Brief notes on what is known of their biology, habitats and zoogeography are included. Identification keys to the genera of Chyromyidae and the species of *Aphaniosoma* in Arabia are also provided.

عائلة Chyromyidae (رتبة ثنائية الأجنحة : Schizophora) من شبه الجزيرة العربية مع وصف لأنواع جديدة

مارتن. ج. إبيجر

خلاصة: يتضمن البحث أول عرض لعائلة Chyromyidae من شبه الجزيرة العربية. وقد تم تسجيل ١٣ نوعاً تابعة للجنس *Aphaniosoma*، ٧ منها تم وصفها لأول مرة وهي: *A. arabicum*، *A. brunnipes*، *A. deemingi*، *A. dhofaricum*، *A. gallagheri*، *A. harteni*، *A. yittii*؛ وكذلك تم تسجيل نوعان لكل من الجنسين *Somatiosoma* و *Gymnochiromyia* ووصف النوع *G. punctata* لأول مرة. كما يحتوي البحث على ملاحظات مختصرة عن ما هو معروف عن بيولوجية ومواطن والتوزيع الجغرافي لهذه الأنواع وكذلك وضعت مفاتيح تصنيفية لتعريف أجناس عائلة Chyromyidae وأنواع الجنس *Aphaniosoma* في الجزيرة العربية.

INTRODUCTION

The Chyromyidae are a family of small flies consisting of relatively few species most of which have been described from around the Mediterranean although they are found in all zoogeographical regions. There are no published records of Chyromyidae from Arabia and the purpose of this article is to give an account of this family in the Arabian Peninsula.

Very little is known of the biology and immature stages of these insects. No complete life-histories are known and no immature stages have been described. They are considered to be most closely related to the Heleomyzidae, a family of flies with most members feeding as saprophytes in bird and mammalian nests, and in organic debris of plant or animal origin. Chyromyidae have likewise been associated with the nests of birds and mammals as well as the roosting places of bats. Adults have been reared from bat guano, bird and mammalian nests, and from debris in the hollows of tree trunks (COLLIN 1933, SMITH 1989, EBEJER 1993). I have reared three species of *Aphaniosoma* from loose soil at the base of low-growing dense vegetation (mainly *Phragmites* and

Salicornia) at Salina salt marsh in Malta. Their pupation period was not less than three weeks. Only a very few puparia were subsequently found. These are minute and covered with debris which renders them very inconspicuous. Adults of this genus have usually been collected in marshy and sandy localities often in the vicinity of reeds and tamarisk trees. FREY (1958 a) noted them feeding on the flowers of the latter. Apart from the flowers of tamarisk, I have also collected them from the flowers of *Salicornia*, *Euphorbia* and *Foeniculum*. Species of the genera *Chyromya* Robineau-Desvoidy, 1830, *Gymnochiromyia* Hendel, 1933, and *Somatiosoma* Frey, 1958, have been collected in various habitats ranging from woodland to meadows and sand dunes as well as entrances to bat caves. *Chyromya* has also been collected indoors at windows. Although this family is generally poorly represented in collections I have encountered several species in large numbers in suitable habitats, where they seem to congregate in one or other particular small patch of vegetation or on one side of a bush or tree. The reasons for such clustering are not understood but this habit is quite common in Diptera.

MATERIALS AND METHODS

Most of the material for study was collected by J.C. Deeming, M.D. Gallagher and myself in Oman. Some specimens were collected by Dr. A. van Harten from Yemen and by Prof. W. Büttiker and A.S. Talhouk in Saudi Arabia. In Oman, *Aphaniosoma* were collected by sweeping reeds and low vegetation and by light trapping on coastal dunes and marshes. Some have turned up in Malaise traps with a species of *Somatiosoma*. Dr. A. van Harten collected *Gymnochiromyia* with light traps and by sweeping alfalfa in Yemen. The relative absence of these insects from mangrove marshes is noteworthy, only one specimen being collected from such a site in Oman, a few hundred metres away from a very productive reed marsh which was sampled only a few minutes earlier (see records below). This sampling was done systematically with the intention of comparing the dipterous fauna of the two sites.

The specimens were collected dry. A few were stored in 70 % alcohol. The abdomens of selected males were macerated in 10 % potassium hydroxide for 20-40 minutes at room temperature, neutralised with glacial acetic acid, washed in 70 % alcohol and stored in glycerine tubes mounted with the specimens. If the abdomen was shrunken, it was first wetted in water with a minute quantity of detergent for a period varying from an hour to a day. Some pale specimens were not macerated but only wetted before washing in alcohol and storing in glycerine.

The classification and nomenclature follows that adopted by SOÓS (1984) in the Catalogue of Palaearctic Diptera, where *Chyromya*, *Gymnochiromyia* and *Somatiosoma* are given generic status. Previously, the latter two were considered to be subgenera of *Chyromya*. The characters used to separate these three genera are rather tenuous and I have seen undescribed species which are intermediate. Further work therefore, may reveal that *Gymnochiromyia* and *Somatiosoma* do not deserve full generic status.

The main wing veins and thoracic sclerites referred to in the descriptions are illustrated diagrammatically in Figs 1 and 2.

Abbreviations:

- BMNH Natural History Museum, London
- NHMB Naturhistorisches Museum, Basel
- NMWC National Museum of Wales, Cardiff

| | |
|---------|-----------------------------------------------------|
| ZMHU | Zoologisches Museum der Humbolt-Universität, Berlin |
| acrs | acrostichal |
| dc | dorsocentral |
| hu | humerus |
| hypopl | hypopleuron |
| ia | intra-alar |
| msn | mesonotum |
| mspl | mesopleuron |
| mtn | metanotum |
| ntpl | notopleuron |
| posthu | posthumeral |
| prescut | prescutellar |
| presut | pretransverse (anterior to) suture of mesonotum |
| ptpl | pteropleuron |
| pvt | postvertical |
| sa | supra-alar |
| scut | scutellum |
| stpl | sternopleuron |
| vt | vertical |

SYSTEMATIC ACCOUNT

Key to the genera of Chyromyidae

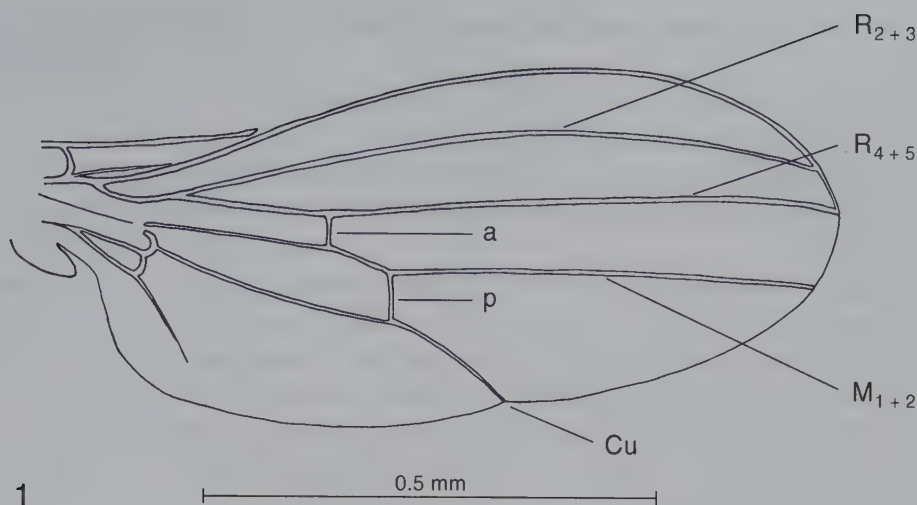
- | | | |
|---|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
| 1 | Three long orbitals present, anterior one curved medially; acrostichals, at the level of the transverse suture in 4-8 rows; occiput more or less convex | 2 |
| – | One to five orbitals, none curved medially, 1-4 short hairs in front; two rows of acrostichals (except in <i>A. deemingi</i> n. sp.); 0.7-2.5 mm <i>Aphaniosoma</i> | |
| 2 | Scutellum, apart from apical and basal strong marginal bristles, with additional hairs on dorsal surface; eyes round; head higher than long | 3 |
| – | Scutellum, apart from marginal bristles, bare; rarely, an additional shorter bristle may be situated adjacent to one of the marginals; eyes oval especially in the male; 1.8-3.0 mm <i>Gymnochiromyia</i> | |
| 3 | Well-developed presutural dorsocentral bristle; acrostichals in 4-6 rows; the additional bristles and hairs on the scutellum tend to be grouped near the marginals and vary markedly in length; 2.5-8.0 mm <i>Chyromya</i> | |
| – | No well-developed presutural dc; acrostichals in 6-8 rows; the additional scutellar bristles are short, hair-like and more or less uniformly scattered on the scutellum; 1.5-3.0 mm <i>Somatiosoma</i> | |

Key to Arabian species of *Aphaniosoma*

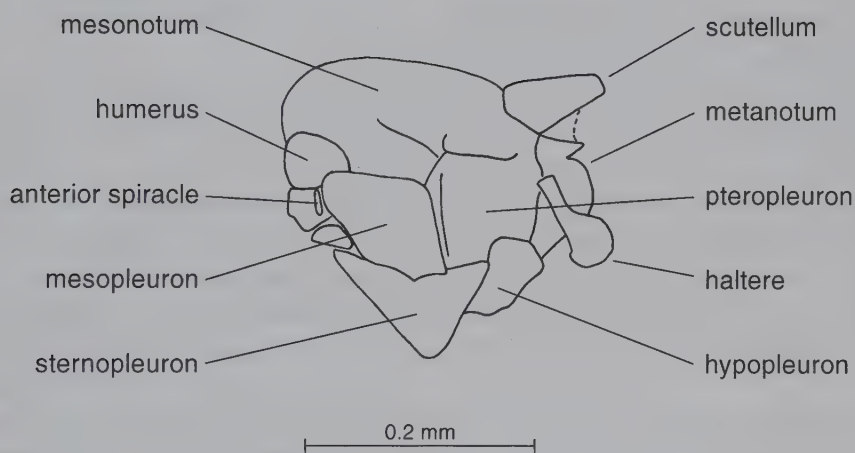
For species not illustrated in this article see COLLIN (1949)

Males

- | | | |
|---|--------------------------------------------------------------------------------------------------------------------|---|
| 1 | Acrostichals in 6-8 irregular rows; anterior dorsocentral indistinguishable from them; eyes usually round. | 2 |
|---|--------------------------------------------------------------------------------------------------------------------|---|



1



2

Figs 1-2: *Aphaniosoma*: 1, wing with principal veins labelled. a = anterior crossvein, p = posterior crossvein; 2, lateral aspect of thorax with the main sclerites labelled.

- Acrostichals always in two rows, even if a little irregular, and easily separable from dorsocentrals; eyes often elongated and oblique 3
- 2 Only one differentiated orbital; no mesonotal stripes, frons broader than eye, head higher than long (the male of this new species is unknown but the characters of the female used here will probably apply equally well) *A. deemingi* n. sp.
- More than one orbital, or mesonotum striped, or frons narrower than eye
non-Arabian species
- 3 Hind trochanter with a distinct process developed on its posterior inner surface
Mediterranean species
- Hind trochanter without such a development 4

- 4 Legs with a distinct brown band on the middle third of each femur and tibia
A. brunnipes n. sp. 5
- Legs entirely yellow, at most only fifth tarsal segment dark 5
- 5 No well-developed presutural intra-alar bristle 6
- Well-developed presutural intra-alar and dorsocentral present; all bristles very long, longer than scutellum; mesonotum with indistinct pale yellow stripes; hypopygium as in Fig. 12
A. harteni n. sp.
- 6 Frons with a pair of long proclinate bristles in front of ocellar triangle; occiput, mesonotum and scutellum usually dark grey with the mesonotal stripes indistinct and confluent in the anterior half; if scutellum and area of mesonotum in front of it yellow, then this paler area extends forwards along the lines of the bristles 7
- Frons with only short hairs (if rather long as in *A. fissum*, not longer than posterior orbitals); yellow species; mesonotum with or without dark stripes on a yellow ground colour; in some species, parts of pleura and occiput may be brown but scutellum, mesopleuron and pteropleuron always clear yellow 13
- 7 Scutellum yellow and pale area on mesonotum in front of it extends forwards along the line of dorsocentrals; sternopleuron and hypopleuron darkened as in Fig. 3 d; two orbitals 8
- Scutellum never clear yellow, usually grey or black; pleura usually more extensively darkened except in *A. dhofaricum* n. sp. (Fig. 3) 9
- 8 Hypopygium with yellow processes
A. sodalis
- Hypopygium with black processes (Figs 13-14)
A. yittii n. sp.
- 9 Hypopygium without black processes, aedeagus not pigmented 10
- Hypopygium with 1-3 dark processes adjacent to basiphallus; aedeagus deeply pigmented (Figs 7-8 and 10-11) 11
- 10 Anterior thoracic spiracle lying in a yellow area; mesopleuron with dark spot occupying the middle third, pteropleuron yellow (Fig. 3 b); basiphallus truncate at ventral apex, distiphallus angled at middle, ending in broad curved lobes (Fig. 4)
A. arabicum n. sp.
- Anterior spiracle lying in a black area; at least mesopleuron darkened over two thirds of its area (Fig. 3 a); basiphallus sharply pointed at apex
A. approximatum
- 11 Hypopygium with two black processes, distiphallus triangular (no wings) (Figs 10-11)
A. gallagheri n. sp.
- Hypopygium with one or three dark processes and distiphallus bilobed (divergent “wings”) 12
- 12 Pleura extensively darkened, usually only some sutures yellow (Fig. 3 c); three dark processes adjacent to aedeagal complex, the middle one with hairs at tip; distiphallus short bilobed, length 1.5 times width
A. creperum
- Pleura dark only on sternopleuron and hypopleuron (Fig. 3 d); one pair of dark processes, and these are usually crossed just below the cerci; distiphallus very long bilobed, length at least twice width (Figs 7-8)
A. dhofaricum n. sp.
- 13 Abdomen, viewed from behind with two dark, shiny, oval spots laterally on the pregenital tergite, no obvious projections from the genital opening; two posthumeral bristles
A. oculicauda
- Hypopygium without black spots but with distinct projections below the cerci 14
- 14 Hypopygium, viewed from behind, with a pair of long pale yellow lamellae (easily visible without dissection)
A. lamellatum

- Hypopygium with two pairs of small yellow projections below the cerci on each side of the basiphallus *A. fissum*

Females

Females are much more difficult to separate than males and this key is incomplete where there are no diagnostic characters or the female is unknown.

- 1 Acrostichals in six irregular rows *A. deemingi* n. sp.
- Acrostichals in two rows; when irregular, these are still easily separable from the dorsocentrals. 2
- 2 Frons with a black horizontal band between ocellar triangle and antennae (not to be confused with the less distinct semicircular darkening concave towards ocelli, often seen on some females of several species); all femora and tibiae with a brown ring on middle third *A. brunripes* n. sp.
- Legs entirely yellow. 3
- 3 Frons, in front of ocellar triangle, with a pair of well-developed bristles, as long as or longer than the posterior orbitals 6
- No bristles on the frons as developed as the long orbitals; often with several scattered short hairs only. 4
- 4 All head and thoracic bristles very long; in addition there is a strong presutural intra-alar *A. harteni* n. sp.
- All bristles shorter and no presutural intra-alar present 5
- 5 Four orbitals; two pairs of short frontals in front of ocellar triangle; pregenital tergite mainly yellow *A. fissum*
- Six short orbitals; pregenital tergite mainly black *A. oculicauda*, *A. lamellatum*
- 6 Mesonotum, scutellum and pleura extensively darkened (Fig. 3 c); tergites of abdomen very narrowly yellow along hind margin *A. creperum*
- Scutellum and area of mesonotum in front of it often paler; if mesonotum with stripes, these are confluent anteriorly; pale areas on pleura more extensive, abdomen often less dark or dark areas less extensive 7
- 7 Mesopleuron and pteropleuron always yellow (Fig. 3 d); paler area of mesonotum in front of scutellum when present not sharply demarcated. 8
- At least mesopleuron dark on about two thirds of its area (Fig. 3 a); paler area of mesonotum in front of scutellum more distinct, its anterior border straight in the middle part, forming a transverse division between the dark and light areas approximately one third to one half of the way between the scutellum and the head; abdomen white-haired; yellow hind margin of tergites becoming broader laterally on the apical segments; scutellum often pale grey with a yellowish tinge but never clear yellow *A. approximatum*, *A. gallagheri* n. sp.
- 8 Yellow area of mesonotum in front of scutellum, when present extends forwards along line of intra-alars; tergites brown-haired and with pale margin becoming broad on sides; tergite 6 always with two black, relatively shiny patches separated by a yellow longitudinal stripe *A. dhofaricum* n. sp.
- Yellow area in front of scutellum more extensive, and extends forwards along dorso-central and intra-alar lines; anterior to transverse suture, mesonotal stripes often reduced leaving a yellow area behind the head; abdomen with brown band on tergite 6 undivided (*A. arabicum* n. sp. and *A. yittii* n. sp. females are unknown but would most probably run to this couplet.) *A. sodalis*

Family Chyromyidae

Genus *Aphaniosoma* Becker, 1903

Aphaniosoma Becker, 1903. — Mitt. zool. Mus. Berlin 2 (3): 186. Type species *Aphaniosoma approximatum* Becker, 1903 (loc. cit.), by original designation.

Aphaniosoma approximatum Becker, 1903 (Fig. 3 a)

Aphaniosoma approximatum Becker, 1903. — Mitt. zool. Mus. Berlin 2 (3): 186. Type locality: Egypt, Cairo, Luxor (types, ZMHU, seen by COLLIN 1949).

Material: Saudi Arabia: 3 ♀♀, Hofuf, 13.IV.1978, W. Büttiker; 1 ♀, Hofuf, 21.IV.1976, W. Büttiker; 1 ♂, 31 ♀♀, Hofuf, 28.V.1978, W. Büttiker; 1 ♀, Hofuf, 7.V.1978, W. Büttiker; 2 ♂♂, 3 ♀♀, Riyadh, 22.VIII.1978, A.S. Talhouk; 1 ♂, Riyadh, 19.IX.1979, A.S. Talhouk, NHMB. — Oman: 1 ♂, Muscat, Al-Khuweir, 5-9.I.1988, M.J. Ebejer; 2 ♀♀, Muscat, Ruwi, Wattayah, 1-7.IV.1988, M.D. Gallagher; 6 ♂♂ (one in glycerine), 2 ♀♀, Muscat, Al-Ansab, 23.II.1989, M.J. Ebejer, NMWC.

There appears to be some variability of colour in this species such that the (few) darker forms look similar to *A. creperum* while the paler forms resemble *A. gallagheri* n. sp. The type series was examined by Collin but no dissections were made. COLLIN (1949), however, illustrated the external features of the male hypopygium and he determined a specimen in the Natural History Museum, London as *A. approximatum*. This specimen I have seen and the determinations of *A. approximatum* above are based on this. The typical colouration of the pleura based on the Arabian material examined is illustrated (Fig. 3 a). The aedeagus in this species is pale, at least towards the ventral apex of the basiphallus and there are no black projections adjacent to it. The paralobe is also yellow and distinctly indented posteriorly. Since no type material of this species has been dissected and several similar species are now recognised within this group some doubt remains as to the exact characters which define *A. approximatum*.

Distribution: This species described from Egypt has also been recorded from Italy and Greece, but records from the latter two countries need to be confirmed in view of the several additional species similar to *A. approximatum* that have been described since. The records from Arabia suggest it may be one of the more widespread species in the peninsula. It appears to inhabit coastal salt marshes as well as inland habitats near freshwater.

Aphaniosoma arabicum n. sp. (Figs 3 b, 4)

Holotype: ♂, Oman: Wadi Al-Mu'aydin, 650 m, 1.XI.1990, M.D. Gallagher & J.C. Deeming, NMWC.

Diagnosis: A small species with long frontal bristles, dark mesonotum and yellow pleura. There are no reliable external characters to enable certain identification. However, the hypopygium is distinctive.

Description: Head: Frons yellow, with a pair of long bristles in front of brown ocellar triangle; ocelli black; three orbitals with two hairs in front; frons at level of ocellar triangle 1.5 times width of eye; eyes oval and bare, lying almost horizontal; gena pale, almost white, white-haired, one third height of eye; palp, proboscis and antenna yellow, arista white in its basal half.

Thorax: Dull greyish-yellow with four grey dusted black stripes, confluent anteriorly and with the central pair reaching the scut which is dull yellow; ntpl stripe yellow; chaetotaxy: 1 hu, 0+4 ia, 2 ntpl, one strong prescut dc and five short hairs in front of it; 2 scut; mtn black, only membrane between it and inferior surface of scut yellow; pleura (Fig. 3 b) with stpl having a well-defined, inverted, black triangle; mspl diffusely darkened only centrally; other pleura mostly yellow.

Wing: Hyaline with pale brown veins; distance between R_{2+3} and R_{4+5} is half that between R_{4+5} and M_{1+2} ; apical section of vein Cu three times length of posterior crossvein.

Legs: Yellow and pale brown-haired; the last tarsal segment darkened.

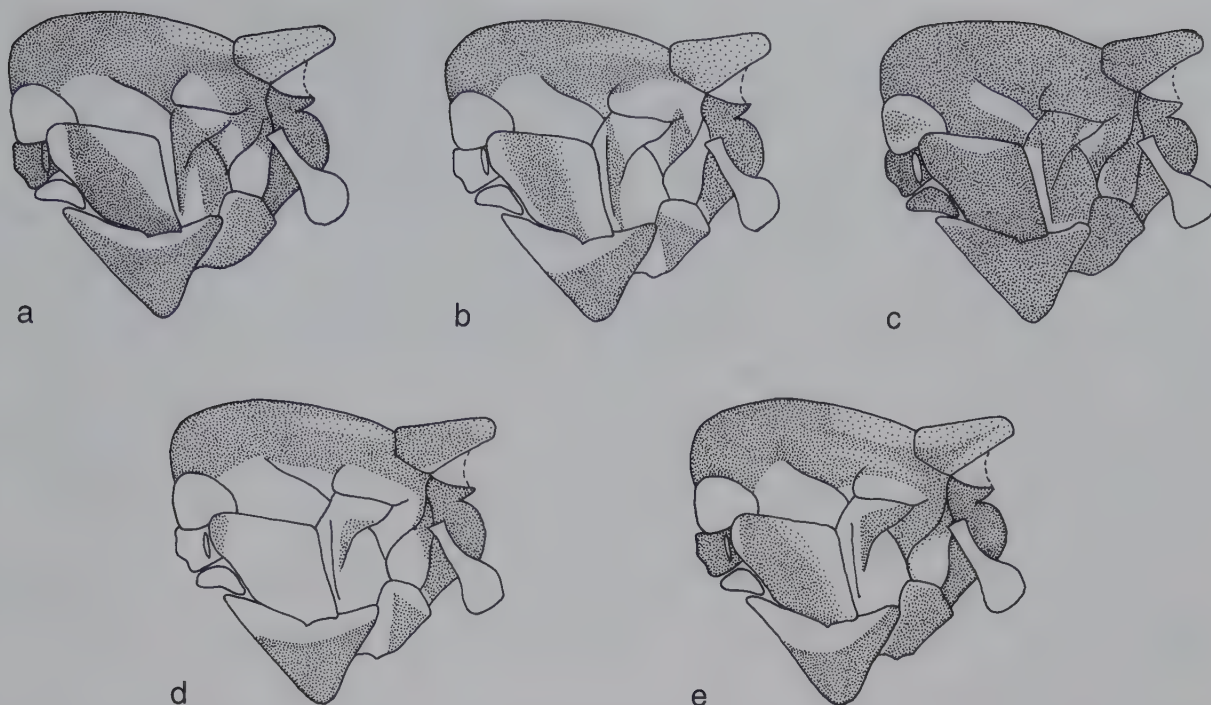


Fig. 3: *Aphaniosoma*, thorax viewed from the side to show pleural markings: a, *A. approximatum*; b, *A. arabicum* n. sp.; c, *A. creperum*; d, *A. dhofaricum* n. sp.; e, *A. gallagheri* n. sp.

Abdomen: Brown with pale bands only along the posterior margin; hypopygium (Fig. 4) pale, with relatively pointed cerci, basiphallus truncate at its ventral apex and without any adjacent projections but with an oblique sclerotised ridge basally; distiphallus markedly angled at its middle and apically ending in two large, poorly sclerotised "wings" which are broad and rounded.

Female: Unknown.

Length: ♂ 0.8 mm.

Distribution: Oman; known only from the type locality.

Affinities: The general dark colouration, long pair of frontal bristles and the hypopygium immediately place this species in the *A. approximatum-creperum*-group (COLLIN 1949). Certain identification is only possible by examination of the male hypopygium.

Etymology: The species is named after the region which has yielded so many species.

Aphaniosoma brunnipes n. sp. (Figs 5-6)

Holotype: ♂, Oman: Muscat, Seeb airport dunes, at m.v. light, 22.X.1990, J.C. Deeming and M.D. Gallagher. — Paratypes: 1 ♂, 4 ♀♀, same data as holotype; 2 ♂♂, Muscat, Azaiba marsh, 9.II.1989, M.J. Ebejer. Holotype and all paratypes in NMWC.

Diagnosis: A dark grey species with a distinct black transverse band on the frons and broad brown bands on the legs.

Description: Head: Yellow, as wide as thorax, occiput black apart from narrow postocular margin; across the frons lies a distinct black transverse band somewhat closer to the black ocellar triangle than to the antennae; frons almost parallel-sided and broad, occupying more than one third total width of head; five orbitals of equal length and equally separated from one another, one internal and one external vt, pvt very short, few scattered frontal hairs with a pair in front of ocellar

triangle only a little longer than the rest; all head bristles and hairs pale yellow; eyes bare, gena narrow, three quarters diameter of eye (when seen from the side and measured along an oblique line approximately at 45°), its posterior part brownish; mouth margin narrowly but distinctly brown; palp pale brown, obviously darker than the yellow proboscis; antenna with segments one and two yellow, the third brown (dark brown in some paratypes), flagellum of arista black.

Thorax: Msn dark grey and completely unstriped, greyish-brown dusted; scut and sa ridge dull greyish-yellow; hu and ntpl yellow; pleura dark greyish-brown except for a narrow yellow line running from above the base of the front coxa through the upper borders of the stpl and hypopl; mtn black, only upper half or less of membrane joining it to scut dull yellowish; chaetotaxy: 2+7 dc, only the prescut well developed, the rest hair-like; 0+4 equally short ia, 1 hu, 1 posthu, 2 ntpl, acrs very short and well separated from dc rows.

Wing: Hyaline and veins pale yellow; R_{4+5} and M_{1+2} diverge towards apex; costal sector between R_{2+3} and R_{4+5} is two thirds the length of costal sector between R_{4+5} and M_{1+2} ; section of M_{1+2} between the two crossveins is 1.5 times length of posterior crossvein; apical section of vein Cu 2.8 times length of posterior crossvein; haltere with knob almost white.

Legs: Fore coxa brown on basal half, yellow at apex; femora brown except at apical and basal fifths, tibiae over the middle third, and the last three segments of each tarsus brown; hind trochanter normal.

Abdomen: Dark brown and on each tergite; posterior margin narrowly pale yellow; the golden-brown hairs of abdomen somewhat longer than is usual for the genus; postabdomen rather curved forward with no distinguishing external features; hypopygium (Figs 5-6), paralobes narrow and elongate, protruding from the genital capsule; their apex is curved backwards and on the posterior aspect there is a flat yellow flange directed backwards; the aedeagus is very difficult to make out owing to it being deep-seated and barely sclerotised. The hypopygium is enclosed by tergite 6 and the last two sternites.

Female: Very similar to male but in two paratypes the tergites are lighter brown and are pale almost to the middle.

Lengths: ♂ 0.9 mm, ♀ 1.2 mm.

Distribution: Oman; coastal seasonal salt marsh.

Affinities: *A. annulatum* Lyneborg, 1973, from Spain is the only other Palaearctic species with banded frons and legs. However, *A. brunnipes* has the bands on the legs in quite different locations; the frontal proportions, the orbital bristles and the colour of the occiput also differ.

Etymology: The species is named after the brown-banded legs, an unusual feature in this genus.

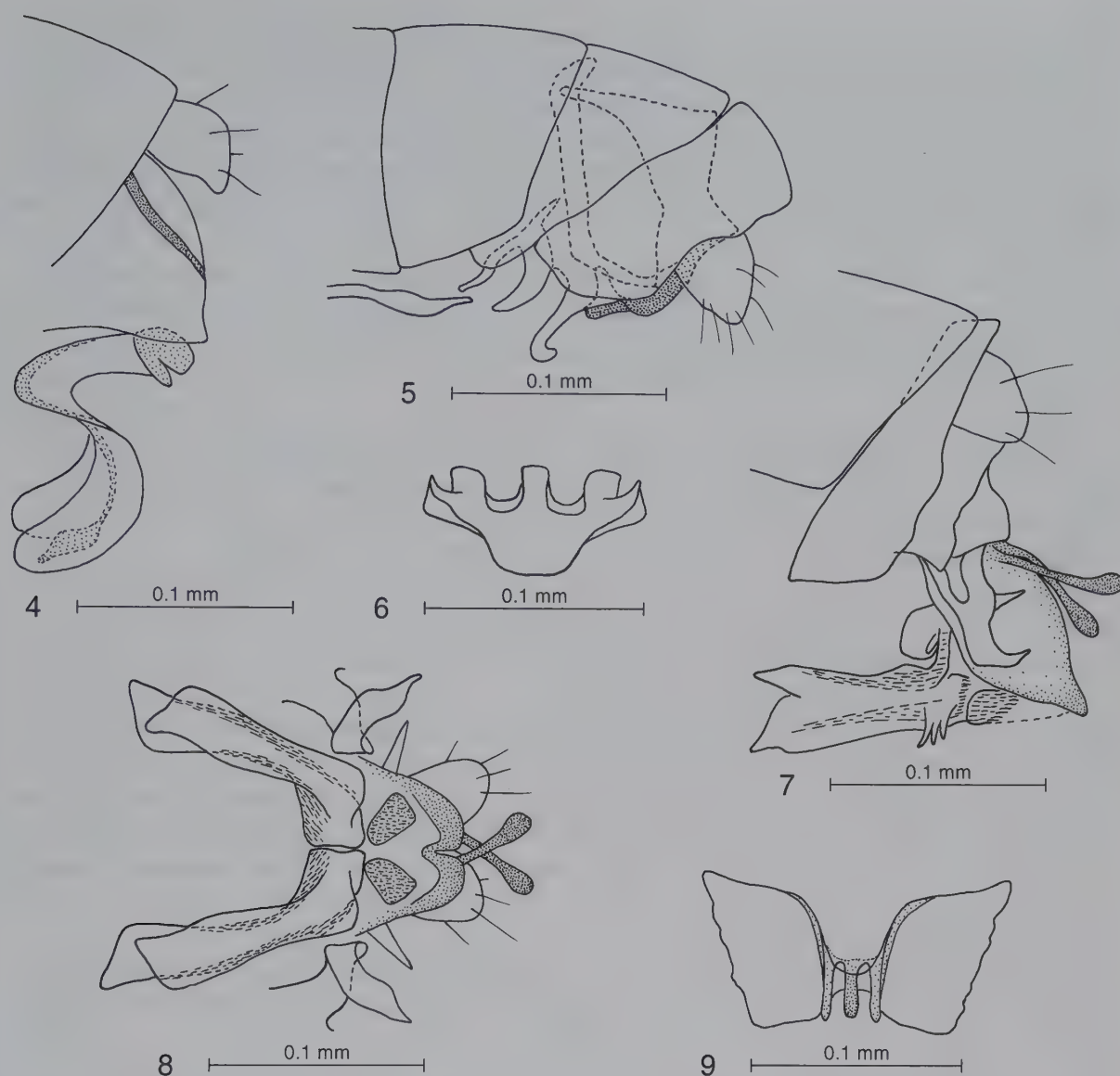
Aphaniosoma creperum Collin, 1949 (Fig. 3 c)

Aphaniosoma creperum Collin, 1949. — Ann. Mag. Nat. Hist. (12) 2: 134. Type locality: Egypt, Siwa, Lake Karoun (types, BMNH, seen).

Material: Oman: 3 ♀♀, Muscat, Al-Ansab, 23.II.1989, M.J. Ebejer, NMWC.

These three specimens are distinctive in having a black mesonotum and scutellum, dark pleura as in *A. creperum* (Fig. 3 c), pale hairs and bristles on the frons but not on the rest of the body and very pale yellow membrane and sternites contrasting with the almost black tergites. Although there are no males and so I cannot be certain of their identity, in my opinion they are most likely to be *A. creperum*.

Distribution: The southern Mediterranean, Egypt and Oman. Habitat as in *A. approximatum*.



Figs 4-9: 4, *Aphaniosoma arabicum* n. sp., ♀, hypopygium, lateral view; 5-6, *Aphaniosoma brunnipes* n. sp., ♀: 5, hypopygium, lateral view; 6, pregenital sternite, ventral view; 7-9: *Aphaniosoma dhofaricum* n. sp., ♀: 7, hypopygium, lateral view; 8, same, ventral view; 9, pregenital sternite, ventral view.

Aphaniosoma deemingi n. sp.

Holotype: ♀, Oman: Dhofar, Khor Rouri, 12.XI.1992, J.C. Deeming, NMWC.

Diagnosis: A distinctive small pale yellow species with only one differentiated orbital, absent postverticals and the acrostichals at the level of the transverse suture in six irregular rows. Although this is the only specimen and it is a female, it is so distinctive from the rest of the species found in Arabia and so easily separable from related species described from the tropics that I feel justified in naming it.

Description: Head: Yellow and almost spherical with the upper part of the occiput concave and with the frons somewhat projecting above the pale yellow antennae; arista a little darkened only in its apical half; at level of ocellar triangle, frons is about 1.5 times width of eye; ocellar

triangle and occiput yellow; gena pale yellow, deep, equal to diameter of eye which is round and bare; palp and proboscis yellow; one short orbital with four minute pale hairs in front; these equal in length to the numerous very pale hairs placed irregularly on the frons; pvt absent.

Thorax: Msn, scut and pleura entirely yellow, only mtn brown; chaetotaxy: acrs in six irregular rows at level of transverse suture; only one prescut pair of acrs well developed; 1 hu, 2 ntpl, 1 pre-scut dc and 1 sa; two pairs of scut; only the well-developed bristles of the msn and scut a little darkened.

Wing: Relatively short, hyaline with pale veins; distance between the crossveins is twice length of anterior crossvein; at the costal margin, R_{2+3} and R_{4+5} diverge slightly, distance between them is 1.2 times the distance between R_{4+5} and M_{1+2} ; haltere white.

Legs: Pale yellow and very pale-haired; hind metatarsus relatively long, more than half length of hind tibia.

Abdomen: Pale yellow with brown transverse bands occupying anterior two thirds of tergites except tergites 2 and 3 which are yellow; tergites 4 and 5 narrowly bisected in the middle by a pale longitudinal line; tergite 6 about 1.5 times length of tergite 5; all hairs very pale.

Male: Unknown.

Length: ♀ 1.1 mm.

Distribution: Oman: Dhofar; at a coastal salt marsh with mixed vegetation including reeds, mangrove and grazed grasses.

Affinities: The following are closely related: *A. sexvittatum* Lamb, 1914, from the Seychelles, *A. thoracale* Hendel, 1913, from Taiwan and *A. minuta* (Hardy, 1980) from Hawaii. I have examined type material of all these species: *A. sexvittatum* is larger, has three long orbitals and six distinct stripes on the mesonotum, *A. thoracale* has two orbitals and the frons only one third the width of the eye. The males of both these species are undescribed. *A. minuta* is very similar to the new species but to date it is known only from Hawaii. It has two orbitals; the abdominal markings are grey not reddish-brown and begin on tergite 2; the new species has only one dorsocentral and the first two tergites are clear yellow.

Etymology: The species is named after J.C. Deeming, who not only collected much of the material on which this article is based but who also suggested that I study this family of Diptera.

Aphaniosoma dhofaricum n. sp. (Figs 3 d, 7-9)

Holotype: ♂, Oman: Dhofar, from coastal reed marsh near Taqah, 23.XI.1988, M.J. Ebejer. — Paratypes: 11 ♂♂, 18 ♀♀, same data as holotype; 8 ♂♂, 8 ♀♀, Dhofar, Mughsail salt marsh, 11.X.1990, J.C. Deeming; 1 ♀, same data but M.J. Ebejer; 5 ♂♂, 9 ♀♀, Dhofar, Salalah, Dahreez coconut plantation, 12.X.1990, J.C. Deeming; 5 ♂♂, 8 ♀♀, same data but M.J. Ebejer; 1 ♀, Dhofar, Salalah, 24.IV.1992, M.D. Gallagher; 1 ♀, Dhofar, Salalah, Dahreez, 9.XI.1992, J.C. Deeming; 1 ♂, 2 ♀♀, Dhofar, Salalah, Rezat Royal Farm, on fodder maize, 10.XI.1992, J.C. Deeming; 3 ♂♂, 5 ♀♀, Dhofar, Khor Salalah, on *Paspalum vaginatum*, 11.XI.1992, J.C. Deeming; 141 ♂♂, 68 ♀♀, Dhofar, Khor Taqah, on carpet grazed *Sporobolus virginicus*, 12.XI.1992, J.C. Deeming. Holotype and all paratypes in NMWC.

Diagnosis: A small species with a pair of long frontal bristles and the dark mesonotum contrasting with the bright yellow pleura. Postabdomen frequently showing the black projections adjacent to the basiphallus.

Description: Head: Yellow; at level of antennae, frons is half the width it is at level of anterior ocellus; frontal hairs about as long as the two anterior orbitals and the distinct pair of frontal bristles in front of the black ocellar triangle are as long as the two posterior orbitals; occiput black with yellow postocular margin; eyes oblique with scanty, very minute hairs; head bristles yellow to pale brown; gena white-haired; antenna entirely yellow, arista mostly black, white only at base.

Thorax: Msn black with grey dusting; on each side a dusky yellow ia line, narrow in front where it commences at the transverse suture and posteriorly merging into a similar coloured area in front of the scut, itself dull yellow, pale only at apex, its inferior surface black; mtn black; membrane separating it from the scut bright yellow; chaetotaxy: 1 hu, 2 ntpl, one long and two short posthu, 0+3 ia, 2+4 dc but only the hindmost well developed, six pairs of relatively long acrs in two rows extending to the level of the hindmost dc; 4 scut; hu and ntpl stripe yellow; pleura (Fig. 3 d) yellow, dark brown only on hypopl, anterior border of ptpl and a triangular patch occupying the lower half of the stpl; mspl and stpl each with a long bristle at its upper posterior corner; all bristles brown.

Wing: Hyaline with brown veins; distance between crossveins is 1.2 times length of posterior crossvein; distal part of Cu is 2.2 times length of posterior crossvein; R_{4+5} and M_{1+2} converge apically; haltere yellow.

Legs: Completely yellow; coxae with white hairs longer than diameter of femora; hind trochanter normal.

Abdomen: Tergites brown with yellow hind margins for about a quarter of their length on tergites 2-4; tergite 6 flattened dorsally and black, yellow only on its sides. Hypopygium (Figs 7-9) with large black phallic complex and a pair of long, black, crossed, club-shaped processes below the yellow cerci; each side of basiphallus and adjacent to the curved pale paralobe is a short, sharply pointed process pointing laterally (visible only on dissection); distiphallus greatly enlarged, bilobed and pigmented.

Female: Very similar to male but without secondary sexual characters on abdomen; abdominal hairing somewhat longer and tergite 6 with a pair of black spots dorsally; one of the female paratypes has the dc arranged 2+6. Some females have, on the frons, an area of darkening in the shape of a crescent concave towards the ocellar triangle. The margins of the dark area are indistinct. This is also a common feature in *A. fissum*, *A. oculicauda*, and *A. sodalis*.

Lengths: ♂ 1.1 mm, ♀ 1.4 mm.

Distribution: Oman; coastal localities but not close to the shore and more often in shaded plantations predominantly near freshwater rather than salt marsh (see note below, under *A. gallagheri* n. sp.). In addition to the above material, there is a single female (Yemen, 1 ♀, Sana'a, VIII.1991, A. van Harten) which runs to *A. dhofaricum* n. sp. in the key and matches the type material very well. I have no data on its habitat. I have determined it as *A. dhofaricum* but I am not designating it as part of the type series.

Affinities: The whole of the *A. approximatum-creperum* species complex can be separated on external characters when series of each species are seen together. Nevertheless, certain identification demands examination of the male hypopygium. The characters given in the key serve to draw attention to the main features.

Etymology: The species is named after the region in Oman where it was discovered.

Aphaniosoma fissum Collin, 1949

Aphaniosoma fissum Collin, 1949. — Ann. Mag. Nat. Hist. (12) 2: 138. Type locality: Egypt, Siwa, Lake Karoun (types, BMNH, seen).

Material: Oman: 2 ♂♂, 1 ♀, Muscat, Wattayeh, 21.IV.1988, Malaise trap, M.D. Gallagher; 1 ♂, Muscat, Azaiba, 2.XI.1989, M.J. Ebejer; 2 ♂♂, 4 ♀♀, Batinah, Rumais, from weedy egg-plant plantation, 5.XII.1992, J.C. Deeming, NMWC.

This species was described by COLLIN (1949) from Egypt. The specimens listed above agree well with the type material in the Natural History Museum, London.

Distribution: Previously known only from Egypt at an inland oasis. In Oman found also in coastal salt marsh and in plantations.

Aphaniosoma gallagheri n. sp. (Figs 3 e, 10-11)

Holotype: ♂, Oman: Dhofar, Mughsail salt marsh, on *Sporobolus virginicus*, 11.X.1990, J.C. Deeming. — **Paratypes:** 25 ♂♂, 26 ♀♀, same data as holotype; 8 ♂♂, 7 ♀♀, same data but M.J. Ebejer; 12 ♂♂, 7 ♀♀, Dhofar, coastal reed marsh near Taqah, 23.IX.1988, M.J. Ebejer; 2 ♂♂, 4 ♀♀, Dhofar, Salalah, Khor El Baleed, on mixed *Phragmites* and *Juncus*, 11.XI.1992, J.C. Deeming; 4 ♂♂, 14 ♀♀, Dhofar, Khor Salalah, on *Paspalum vaginatum*, 11.XI.1992, J.C. Deeming; 19 ♂♂, 19 ♀♀, Dhofar, Khor Taqah, on carpet-grazed *Sporobolus virgatum*, 12.XI.1992, J.C. Deeming. Holotype and all paratypes in NMWC.

Diagnosis: A small grey species appearing pale because of dense white dusting. The frons with a pair of bristles in front of ocellar triangle. The central stripes of the mesonotum confluent and squared off at about the middle of the mesonotum. Male postabdomen with distinct black projections.

Description: Head: Orange (in several specimens yellow); frons at level of antennae two thirds its width at the vertex, where it is about half width of head; ocellar triangle small; black; ocelli very close together; the two posterior orbitals are 1.5 times length of the three anterior ones; frontal hairs short except for two pairs in front of ocellar triangle, both pairs about as long as the upper orbitals; one internal and one external vt; all hairs and bristles white; occiput black with a broad yellow postocular margin; eyes hairy, more narrow than is usual for the genus and lie almost horizontal; gena narrow, half height of eye; palp and proboscis orange-yellow; antenna dusky yellow, arista pale brown.

Thorax: Msn pale grey with dense greyish-white dusting; the thoracic stripes are confluent in front of transverse suture, and behind this form a very broad middle band not quite reaching the level of the wing bases; the stripe lateral to this reaches just beyond level of the wing bases and on it lie the dc bristles, the most lateral stripe commences behind the transverse suture and reaches the scut which is dull yellowish-grey with a brown line on its lateral margin; mtn black; pleura yellow, marked with grey or brown on all sclerites (Fig. 3 e); stpl has a long white bristle at its upper posterior corner and two smaller ones in front; mspl has one long bristle at the posterior corner and one in front; hu and ntpl yellow; chaetotaxy: 2+7 dc, only the posterior strong though not particularly long and the rest hair-like; 2 hu, 1 posthu, 2 ntpl, 0+4 ia, 4 scut, acrs very short, reach scut and are well separated from the dc; bristles white (or, in some specimens, the stronger ones pale yellow).

Wing: Hyaline with most veins colourless; costal sector between R_{4+5} and M_{1+2} is twice the length of the costal sector between R_{2+3} and R_{4+5} ; the section of vein M_1 between crossveins is 1.75 times length of posterior crossvein and distal section of Cu is 3.25 times length of posterior crossvein; haltere very pale, almost white.

Legs: All very pale yellow and white-haired; hind trochanter normal.

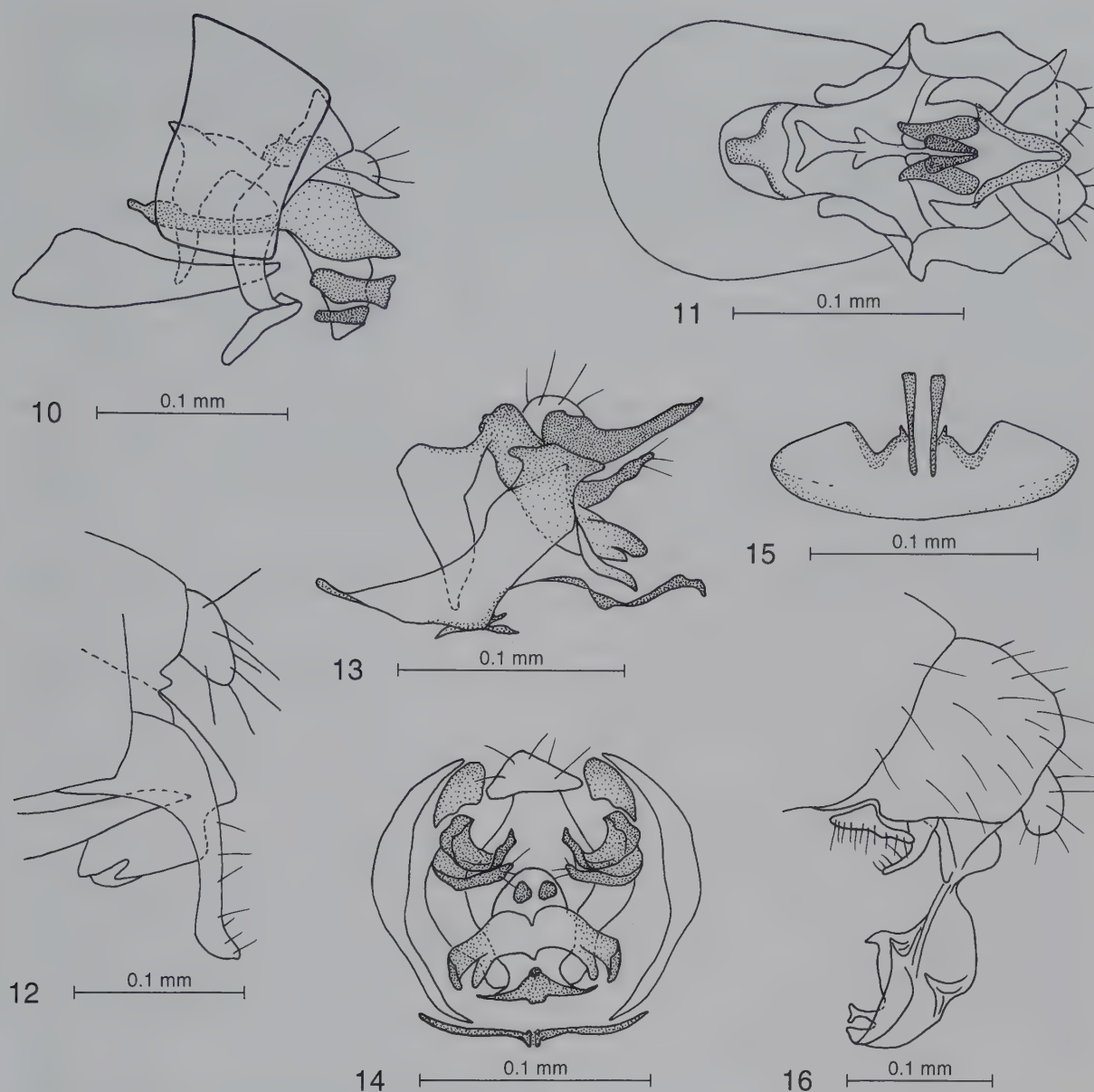
Abdomen: Tergites greyish-brown with very pale narrow posterior border becoming broader laterally in the apical segments; hairs white; hypopygium as in Figs 10-11; in most specimens the basiphallus projects below the cerci which in turn have lateral to them a yellowish-brown projection pointing upwards and laterally; aedeagus pigmented, short and bilobed apically; pregenital sternite (Fig. 11) large and U-shaped.

Female: Similar to male but several specimens have the posterior pale borders to the tergites somewhat broader.

Lengths: ♂ 0.9 mm, ♀ 1.3 mm.

Distribution: Oman; on exposed short grasses bordering salt marsh.

Affinities: This small species resembles *A. approximatum*, *A. creperum* and *A. dhofaricum* n. sp. It differs in having the mesonotum distinctly striped though confluent anteriorly, the hairs and bristles almost white, and the wing likewise showing minimal pigment on the veins which, in most specimens, are darkened only on the costa. The hypopygium belongs to the "*A. creperum*"-



Figs 10-16: 10-11, *Aphaniosoma gallagheri* n. sp., ♀: 10, hypopygium, lateral view; 11, same, ventral view; 12, *Aphaniosoma harteni* n. sp., ♀, hypopygium, lateral view; 13-15, *Aphaniosoma yittii* n. sp., ♀: 13, hypopygium, lateral view, sixth tergite not included; 14, hypopygium, posterior view; 15, pregenital sternite, ventral view; 16, *Gymnochiromyia punctata* n. sp., ♀, hypopygium, lateral view.

group but is distinctive even in some dried specimens without dissection because of the shape and position of the projections viewed from behind; the distiphallus is very short bilobed.

Etymology: The species is named after Mr. M.D. Gallagher who collected much fine material of this family and contributed so much to the study of Oman's natural history.

Aphaniosoma harteni n. sp. (Fig. 12)

Holotype: ♂, Yemen: Sana'a, VIII.1991, A. van Harten. — **Paratypes:** 3 ♂♂, 3 ♀♀, VII.1991, light trap, A. van Harten; 1 ♂, Sana'a, VIII.1991, A. van Harten. Holotype and paratypes in NMWC.

Diagnosis: A relatively large extensively yellow species with remarkably long bristles. Male postabdomen with a characteristic pair of long sickle-shaped processes below the cerci.

Description: Head: Entirely yellow; frons parallel-sided with scattered brown hairs; ocellar triangle, occiput, gena and antenna yellow, arista brown; two very long orbitals with three short hairs in front; eyes bare, oval and lying oblique.

Thorax: Entirely yellow, only the mtn black; msn with six waxy yellow stripes not reaching the scut; chaetotaxy: all bristles very strongly developed, 1 hu, 1 posthu, 1+3 ia, the presut very long, 2 ntpl, 1 sa and 1+3 dc, the first and the prescut the longest; acrs in two rows which are very close together, the hindmost pair situated just in front of the scut; mspl with a long bristle at its upper posterior corner and similarly the stpl which in addition has two shorter pale bristles in front; bristles on msn and scut dark.

Wing: Relatively long with yellow veins; R_{2+3} and R_{4+5} converge at the costal margin so that distance between them is just less than half distance between R_{4+5} and M_{1+2} ; haltere yellow.

Legs: Yellow with brown hairs; fore femur with a posteroventral row of bristles longer than diameter of the femur; mid coxa with long white hairs; fifth tarsal segment on all legs black; hind trochanter normal.

Abdomen: Yellow but tergites with pale brown bands at base, occupying less than half the length; tergite 4 with lateral bristles longer than tergite itself, tergite 5 completely yellow, equal in length to tergite 4 and with longer paler bristles on sides; hypopygium (Fig. 12) entirely pale with two characteristic and conspicuous long curved processes on each side with hairs on the narrow part posteriorly; cerci with unusually long hairs.

Female: Similar to male but without secondary sexual characters on abdomen; one of the paratypes has an additional dc.

Lengths: ♂ 1.8 mm, ♀ 2.2 mm.

Distribution: Yemen; inland at high altitude, in plantations.

Affinities: I examined the Egyptian species *A. setigerum* Collin, 1949. It is very similar but it has no presutural ia bristle, the fourth tergite is three times the length of the fifth; because the abdomen is curved it was not possible to establish the presence or absence of any hypopygial processes; the fifth tarsal segments and all the bristles on *A. setigerum* are completely yellow. FREY (1958 a) illustrated the hypopygium of *A. rufum* which he had previously described from the Canary Islands. This is quite distinct from that of the new species.

Eymology: The species is named after Dr. A. van Harten who collected this species and contributed significantly to this family of Diptera in Yemen.

Aphaniosoma lamellatum Collin, 1949

Aphaniosoma lamellatum Collin, 1949. — Ann. Mag. Nat. Hist. (12) 2: 137. Type locality: Egypt, Siwa, Lake Karoun (types, BMNH, seen).

Material: Oman: 2 ♀♀, Dhofar, Salalah, Dahreez, on ratooned forage millet, 8.XI.1992, J.C. Deeming; 2 ♂♂, Dhofar, Salalah, Dahreez, 9.XI.1992, J.C. Deeming, NMWC.

This is an easily recognisable species without dissection. Until now it was known only from the type material. COLLIN (1949) illustrates the hypopygium in situ.

Distribution: Oman, Dhofar; from grasses in shaded plantation. Previously known only from an oasis in Egypt.

Aphaniosoma oculicauda Collin, 1949

Aphaniosoma oculicauda Collin, 1949. — Ann. Mag. Nat. Hist. (12) 2: 135. Type locality: Egypt, Siwa, Lake Karoun (types, BMNH, seen).

Material: Oman: 2 ♂♂, 1 ♀, Muscat, Al-Khuweir, 5-9.I.1988, M.J. Ebejer; 1 ♂, Muscat, Al-Khuweir, 10-11.I.1988, M.J. Ebejer; 2 ♂♂, 5 ♀♀, Muscat, Al-Khuweir, X.1990, J.C. Deeming; 1 ♂, Muscat, Qurum, 23.X.1990, J.C. Deeming; 1 ♂, 12 ♀♀, Muscat, Seeb airport marsh, M.J. Ebejer & M.D. Gallagher, NMWC.

This series compares well with the type material. The only exception is the male from Seeb marsh which is rather darker than the rest and has the shining black patches on the sixth tergite more prominent. As it matches on chaetotaxy I have determined it as *A. oculicauda*.

Distribution: Previously known only from Egypt; in Oman it has been found in seasonal coastal salt marsh.

Aphaniosoma sodalis Collin, 1949

Aphaniosoma sodalis Collin, 1949. — Ann. Mag. Nat. Hist. (12) 2: 140. Type locality: Egypt, Siwa, Lake Karoun (types, BMNH, seen).

Material: Oman: 1 ♂, Dhofar, Salalah, Dahreez coconut plantation, 12.X.1990, M.J. Ebejer; 2 ♂♂, 1 ♀, Nakhl, in wet date-palm grove, 18.X.1990, M.D. Gallagher & J.C. Deeming; 2 ♀♀, Dhofar, Salalah, in garden, 24.IV.1992, M.D. Gallagher; 3 ♂♂, 2 ♀♀, Dhofar, Salalah, Dahreez, 2.XI.1992, J.C. Deeming; 1 ♀, Dhofar, Khor Rouri, on *Phragmites*, 12.XI.1992, J.C. Deeming. — Yemen: 1 ♂, 2 ♀♀, Al-Kowd, Malaise trap, 15-28.II.1993, A. van Harten, NMWC.

Distribution: Previously known only from Egypt. In Oman it inhabits the same habitat as *A. lamellatum*. Here it is recorded also from Yemen and like *A. approximatum* it seems to be widespread in the peninsula.

Aphaniosoma yittii n. sp. (Figs 13-15)

Holotype ♂, Oman: Muscat, Yitti, in cultivated site, 20.III.1992, M.D. Gallagher, NMWC.

Diagnosis: A small brown species with a yellow scutellum, mesonotal stripes better separated and not reaching the anterior margin of the mesonotum. Hypopygium seen from behind with several heavily sclerotised black processes visible without dissection.

Description: Head: Yellow, large, 1.3 times as broad as thorax; ocellar triangle brown, with a pair of long frontal bristles in front; at level of anterior ocellus, frons is 1.8 times width of eye which is bare; two short upper orbitals and two minute hairs in front; antenna, palp and proboscis yellow; gena pale and narrow, half height of eye with well-developed vibrissa and pale hairs.

Thorax: Yellow with dense pale greyish dusting on msn which has five longitudinal stripes, the middle pair confluent and tapering posteriorly to the anterior margin of the entirely yellow scut; anteriorly, all the stripes end at the level of the transverse suture; mtn yellow except for a dark spot just below the apex of scut; pleura yellow except for an inverted brown triangle on stpl; chaetotaxy: this specimen is rather denuded in places and so the size of the bristles cannot be ascertained, however, their bases can be seen: 1 hu, 2 ntpl, 0+6 dc, acrs in two rows irregular and wide set, mspl and stpl each with a long bristle at upper posterior corner, stpl with in addition a bristle at anterior corner, all bristles pale brown.

Wing: Normal for the genus; distance between R_{2+3} and R_{4+5} is half distance between R_{4+5} and M_{1+2} ; distance between the crossveins is twice length of anterior crossvein; haltere pale yellow.

Legs: Entirely yellow and yellow-haired; hind trochanter normal.

Abdomen: All tergites brown with a very narrow pale posterior margin; hypopygium (Figs 13-15) very distinctive because the sixth tergite is reduced exposing several heavily sclerotised black processes, some originating from the inner surface of the epandrium, others from the basiphallus; the yellow cerci are asymmetrical and fused; aedeagus is unusually flat with a narrow pointed apex and also heavily sclerotised.

Female: Unknown.

Length: ♂ 1.1 mm.

Distribution: Known only from the type locality in Oman.

Affinities: If one assumes that like several other species, the colouration will vary, then the new species could be considered similar to *A. sodalis*, *A. fissum*, *A. lamellatum*, *A. oculicauda*, and *A. arabicum* n. sp., bearing greatest similarity to the first. However, even before dissection the hypopygium is totally different to any of the above.

Etymology: The species is named after the locality where it was collected.

Aphaniosoma sp. indet. (1)

Material: Oman: 2 ♀♀, Dhofar, Ain Hamran, 10.X.1990, J.C. Deeming, NMWC.

These specimens may represent a new species, but without a male it is impossible at present to be certain.

Aphaniosoma sp. indet. (2)

Material: Oman: 1 ♀, Muscat, Al-Khuweir, 5-9.I.1988, M.J. Ebejer; 5 ♀♀, Dhofar, reed marsh near Taqah, 23.IX.1988, M.J. Ebejer, NMWC.

I am unable to determine with any certainty the females listed above, nor can I be sure they belong to the same species. They are similar to *A. notatum* Collin, 1949 (female unknown) and *A. sodalis*. The specimen from Al-Khuweir being particularly pale, could be any one of several species from the Mediterranean.

Aphaniosoma sp. indet. (3)

Material: Yemen: 1 ♂, 1 ♀, Sana'a, VII.1991, A. van Harten, NMWC.

The female is well preserved but it could be one of several species. The male is in poor condition.

Aphaniosoma sp. indet. (4)

Material: Yemen: 1 ♂, 2 ♀♀, Aden, Little Aden, 10-12.IV.1993, A. van Harten, NMWC.

These three specimens seem to be a new species but are in too poor a state of preservation to study further. Once dissected, the single male would leave no other recognisable characters.

Genus *Somatiosoma* Frey, 1958

Somatiosoma Frey, 1958 b. — Comment. Biol. 18 (4): 33 (as a subgenus of *Chyromya*). Type species: *Chyromya nitescens* Frey, 1958, by original designation.

Somatiosoma nitescens Frey, 1958

Somatiosoma nitescens Frey, 1958 b. — Comment. Biol. 18 (4): 33. Type locality: Cape Verde Islands.

Material: Yemen: 1 ♂, Sana'a, III.1991, A. van Harten, NMWC.

This single specimen was dissected and compared with a series of *S. nitescens* in NMWC, collected from the Cape Verde Islands, and it matches in all characters including the hypopygium.

Distribution: Cape Verde Islands, Yemen.

Somatiosoma sp. indet.

Material: Oman: 1 ♀, Muscat, Al-Khuweir, 11.I.1988, M.J. Ebejer; 1 ♀, Muscat, Al-Khuweir, 22-23.II.1988, M.J. Ebejer; 6 ♀♀, Muscat, Wattayeh, 1-7.IV.1988, Malaise trap, M.D. Gallagher; 2 ♀♀, Muscat, Wattayeh, 17-20.IV.1988, Malaise trap, M.D. Gallagher. NMWC.

This series of females is distinct from *S. nitescens* and probably represents a new species. Compared to the series of female *S. nitescens* (see above), the species from Oman has a shorter head; the proportions being height/length, 1.7/1.0 (*S. nitescens* 1.3/1.0); the acrs, at the level of the transverse suture, in ten rows and not eight, and tergites 7 and 8 each with a pair of small

round black spots (not to be confused with the single pair of pigmented spermathecae which are often clearly visible through the integument). However, without associated males to dissect I cannot name this species because females are particularly difficult to separate and there are other similar undescribed species of *Somatiosoma* from the Afrotropical Region.

Genus *Gymnochiromyia* Hendel, 1933

Gymnochiromyia Hendel, 1933. — Dt. Ent. Zeitschr. 43. Type species: *Peletophila minima* Becker, 1904. — Zeitschr. syst. Hymenopt. Dipt. 4: 133, by original designation.

Gymnochiromyia punctata n. sp. (Fig. 16)

Holotype: ♂, Yemen: Sana'a, 15.I.1991, swept from alfalfa, A. van Harten. — Paratypes: 2 ♂♂, same data; 1 ♂, light trap, Sana'a, I.1991, A. van Harten; 3 ♂♂, 6 ♀♀, light trap, Sana'a, II.1991, A. van Harten; 3 ♂♂, 2 ♀♀, light trap, Mahwir, VI.1991, A. van Harten; 6 ♂♂, 2 ♀♀, light trap, Sana'a, A. van Harten. — Ethiopia: 1 ♀, Alemaya, VII-VIII.1986, T. Mefsin. Holotype and all paratypes in NMWC.

Diagnosis: A small yellow species with dark, oval, midline spots on all tergites in the female and one dark spot at the tip of the abdomen in the male.

Description: Head: Frons yellow, covered with numerous very fine short white hairs; at level of the yellow ocellar triangle, frons is half width of head; ocelli red; the three pale brown orbitals of almost equal length; eye bare and oval, lying horizontal, vertical diameter almost equal to height of gena; antenna deep yellow, second segment with the dorsal bristle long, equal to 0.7 the length of anterior orbital; arista black apart from first segment which is yellow; occiput, gena and mouthparts yellow.

Thorax: Entirely yellow with pleura almost white; msn with four waxy-yellow stripes which commence just in front of transverse suture; the central pair end at the level of the wing bases and the lateral pair at the origin of the hindmost dc; acrs with only the prescut pair well developed, the rest in six irregular rows; one long prescut dc with two shorter ones in front; 1 hu with a shorter one in front, 2 ntpl, 1 presut ia and 1 sa; scut with only the usual two pairs of long marginal bristles; mtn brown; mspl in the middle of its posterior margin and the stpl at its upper hind corner, each with a bristle; in addition, the stpl has several long white hairs at its lower corner, longer than diameter of hind femur.

Wing: Hyaline, veins yellow; distance between crossveins is three times length of anterior crossvein.

Legs: Yellow with very pale hairs, only the claws black.

Abdomen: Yellow with short sparse brown hairs on the tergites except at the margins where the bristles are dark and longer than half the length of the tergite; apex of abdomen with a distinct black triangular spot just above cerci; hypopygium (Fig. 16): aedeagus long, asymmetrical, spatulate and sclerotised but not pigmented.

Female: Similar to male but bristles darker and hairs generally more numerous and black on the abdomen; each tergite, in the midline, has an oval brown spot becoming darker on the last three segments.

Lengths: ♂ and ♀ 2 mm.

Distribution: Yemen and Ethiopia. This species was taken well above sea level in mountainous terrain but the exact altitude is not given.

Affinities: Most species of *Gymnochiromyia* are very similar on external morphology. Any abdominal markings, and the presence or absence of strong presutural dorsocentrals are helpful characters. It remains essential to examine the male hypopygium for certain identification.

Etymology: The species is named after the characteristic spot on the male abdomen.

Gymnochiromyia sp. indet.

Material: Oman: 2 ♂♂, Dhofar, Salalah, garden, 24.IV.1992, M.D. Gallagher, NMWC.

Both specimens are rather squashed. They are similar to *G. dubia* Lamb, 1914, from the Seychelles, but this species was described from a female. Since the specimens from Oman are not in good condition I prefer not to name them.

Zoogeography

Southern parts of Saudi Arabia, Yemen, and Dhofar in southern Oman are usually considered part of the Afrotropical Region. Among the Chyromyidae there are only three species not of Palaearctic origin. It is interesting to note among them the Afrotropical genus *Somatiosoma* which has now been found in northern Oman.

Several species of *Aphaniosoma* which were originally described from Egypt, not surprisingly, have now been found on the Arabian Peninsula. Apparently two of these, *A. approximatum* and *A. sodalis*, are the most widespread. There are several closely related species in the Mediterranean which have long bristles, long yellow processes in the hypopygium and unusual structural modifications on the hind trochanter in the male. Although *A. harteni* n. sp. has no such trochanteral developments it has all the other features and clearly it is closely related to this Mediterranean group.

It is noteworthy that the species *A. deemingi* n. sp. from Southern Oman is the only species bordering the Palaearctic which belongs to a pan-tropical group. This group (and other undescribed tropical species which I have seen) may belong to a monophyletic group separate from *Aphaniosoma* as interpreted by Becker. They have no well-developed acrostichals except one pair in front of the scutellum, very reduced bristles on the head which is far less flattened than is usual in this genus, in fact it is often higher than long, and the male secondary sexual characters on the postabdomen developed to a lesser degree. Furthermore, based on the species currently known, there appears to be a world-wide division of the two groups with the species having only two rows of acrostichals, inhabiting the Holarctic Region, and those having several rows, inhabiting the tropics. A very few exceptions in each group extend beyond their respective regions where there are insignificant geographical boundaries; for example: along the Nile Valley in Egypt and down the coasts of the Red Sea and West Africa in the Old World; and into the Southern United States from Mexico, in the New World.

It would require a full zoogeographical and phylogenetic analysis of the whole family to establish the true taxonomic relationships of the species within the genus *Aphaniosoma*, a task beyond the scope of this article.

Chyromyia probably occurs in Arabia but I have seen no material and know of no records. *Gymnochiromyia* is widespread in all regions.

The zoogeographic affinities of the material studied may be grouped as follows:

- | | |
|---------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Palaearctic: | <i>Aphaniosoma approximatum</i> , <i>A. arabicum</i> n. sp., <i>A. brunnipes</i> n. sp., <i>A. creperum</i> , <i>A. dhofaricum</i> n. sp., <i>A. fissum</i> , <i>A. gallagheri</i> n. sp., <i>A. harteni</i> n. sp. (Mediterranean), <i>A. lamellatum</i> , <i>A. oculicauda</i> , <i>A. sodalis</i> , <i>A. yittii</i> n. sp. |
| Afrotropical: | <i>Somatiosoma nitescens</i> , <i>Gymnochiromyia punctata</i> n. sp., <i>Gymnochiromyia</i> sp. indet. |
| Oriental: | <i>Aphaniosoma deemingi</i> n. sp. |

Given the paucity of data world-wide it is fair to say that the Chyromyidae are comparatively well represented in Arabia and they show affinities predominantly to the Palaearctic fauna. The genus *Aphaniosoma* consists of particularly minute insects which are frequently overlooked and there remain many undescribed, and no doubt, even undiscovered species from the Afrotropical and Oriental Regions.

ACKNOWLEDGEMENTS

I am grateful to the authorities of the Oman Natural History Museum, Muscat, The Natural History Museum, London and the National Museum of Wales, Cardiff for permission to use their facilities, collections and libraries. I am also grateful to Prof. W. Büttiker for making available to me the specimens from Saudi Arabia and Prof. P.J. Schembri of the Department of Biology, University of Malta for making available laboratory facilities. I am greatly indebted to M.D. Gallagher for all his help in Oman and to J.C. Deeming for his invaluable assistance and encouragement during the preparation of this paper.

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Formicidae (Insecta: Hymenoptera) of Saudi Arabia (Part 2)

Cedric A. Collingwood and Donat Agosti

Abstract: The known species of ants from the entire Arabian Peninsula are listed. The present total of 265 includes three genera new to the Arabian fauna, *Leptanilla*, *Yavnella* and *Solenopsis*, 30 records of species new to the Arabian fauna and, additionally, 56 species new to science: *Cryptopone arabica*, *Messor hismai*, *M. muraywahus*, *M. muscatus*, *M. sanganus*, *Leptothorax saudiae*, *Cardiocondyla gallagheri*, *C. yemeni*, *Tetramorium latinode*, *T. yemene*, *Monomorium acutinode*, *M. aeyade*, *M. asiriense*, *M. baushare*, *M. brunneolucidulum*, *M. buettikeri*, *M. dammame*, *M. dirie*, *M. fayfaense*, *M. fezzanense*, *M. gallagheri*, *M. hanaqe*, *M. harithe*, *M. hemame*, *M. jizane*, *M. knappi*, *M. mahyoubi*, *M. majarishe*, *M. marmule*, *M. matame*, *M. mintiribe*, *M. montanum*, *M. najrane*, *M. qarahe*, *M. rimae*, *M. riyaadhe*, *M. subdenticorne*, *M. suleyile*, *M. tumaire*, *M. wahibiense*, *M. yemene*, *Solenopsis omana*, *S. sumara*, *S. zingibara*, *Anoplolepis longitarsis*, *Lepisiota dammama*, *L. dhofara*, *L. harteni*, *L. riyaadha*, *Cataglyphis acutinodis*, *C. flavobrunneus*, *C. harteni*, *C. holgerseni*, *C. opacior*, *C. shuaibensis*, *Camponotus gallagheri*. *Monomorium karawajewi* is synonymised with *M. mayri*. *Cataglyphis auratus*, *C. vaucheri*, *Crematogaster melanogaster*, *Messor crawlei*, *Pheidole katonae* and *Technomyrmex bruneipes* are given a new status.

عائلة النمل (صنف الحشرات : رتبة غشائيات الأجنحة) من المملكة العربية السعودية القسم الثاني

سدريك. آز كولينغود و دونات أغوستي

خلاصة : يتضمن البحث تسجيل لكافة الأنواع المعروفة من النمل في شبه الجزيرة العربية. إن العدد الإجمالي لها هو ٢٦٥ وتتضمن ثلاثة أجناس جديدة بالنسبة للمجموعة الحيوانية العربية وهي : *Leptanilla* ، *Yavnella* ، *Solenopsis*. كذلك يحتوي البحث على تسجيل لـ ٣٠ نوعاً و ٥٦ نوعاً جديداً للعلم. *Monomorium karawajewi* تم اعتباره مرادف لـ *M. mayri*.

INTRODUCTION

Many collections made in Saudi Arabia by Prof. W. Büttiker during his zoological surveys in 1975-1989 have been made available through Dr. M. Brancucci of the Natural History Museum, Basel. Much material has also been sent from Oman, mainly collected by Mr. M.D. Gallagher of the Oman Natural History Museum, Muscat, and supplemented by collections made by R. Braund, W. Büttiker, J.E. Clarke, J. Darlington, R. Mathias and R.P. Whitcombe. Additional material includes an interesting collection made by W. Büttiker in Kuwait (1988-1989), specimens

from separate ecological studies in the United Arab Emirates by Prof. H. Heatwole of the Zoology Department, North Carolina State University, U.S.A. and Dr. Barbara Tigar of the National Avian Research Centre, Abu Dhabi, and finally important collections from Yemen made by A. van Harten of the Yemeni-German Plant Protection Project assisted by M. Knapp, M. Mahyoub and others. These have been examined, and species known to occur in the Arabian Peninsula now total 265 of which 56 are described as new. Descriptions, name changes and new records are presented but those in COLLINGWOOD (1985) are not repeated.

MATERIALS AND METHODS

Measurements and indices

All measurements are expressed in millimetres and these and all indices are as follows:

| | |
|-----|-----------------------------------------------------------------------------------------------------------------|
| CI | Cephalic index; $HW \times 100$ divided by HL |
| EL | Eye length; the maximum diameter of the eye |
| HL | Head length; the length from the mid point of the front clypeal border to the mid point of the occipital border |
| HW | Head width; the maximum width of the head in dorsal view excluding the eyes |
| PL | Petiole length |
| PW | Petiole width |
| PPW | Postpetiole width |
| SI | Scape index; $SL \times 100$ divided by HW |
| SL | Scape length; the straight line length of the antennal scape not including the condylar bulb |
| TL | Total length; the total outstretched length of the individual |

The various body parts are as delineated in COLLINGWOOD (1985: Fig. 1).

All type material is housed in the Natural History Museum, Basel (NHMB) and duplicates placed in appropriate institutes and museums of the contributing countries.

Collecting Areas

Collections in Saudi Arabia cover the same areas as described in COLLINGWOOD (1985). The two main areas in Oman are Dhofar in the west with a lush wooded coastal plain, cultivated areas and inland desert (RATCLIFFE-SMITH 1980) and the north-eastern part radiating from Muscat including coastal sands, the mountains of Jabal Shams rising to over 2000 m, areas of agricultural cultivation including date palms and finally sandy deserts and adjacent scrub lands. Collections in the United Arab Emirates by Prof. H. Heatwole were in the deserts of Djebel Haffete and in similar terrain around Ras Ghanada by Dr. B. Tigar, using baits and pitfall traps respectively. In Yemen most collections by A. van Harten and colleagues were made on high land around Sana'a but also in semi-cultivated valleys and coastal plains using a variety of methods including light and Malaise traps. Additional material was collected by Dr. H. Wranik of Rostock University in the vicinity of Aden in 1985 and 1988 and included much the same fauna as described by both EMERY (1893) and FOREL (1892) from Taiz and Aden 100 years ago.

List of all recorded Arabian species

| Genera and species | Saudi Arabia | Kuwait | U.A.E. | Oman | Yemen | Range outside Arabia |
|------------------------------------------------|--------------|--------|--------|------|-------|----------------------------|
| Subfamily Dorylinae | | | | | | |
| <i>Dorylus affinis</i> Shuckard, 1840 | | | | | + | North Africa, Middle East |
| <i>D. fulvus</i> (Westwood, 1839) | + | | | + | + | North Africa, Middle East |
| Subfamily Leptanillinae | | | | | | |
| <i>Leptanilla islamica</i> Baroni Urbani, 1977 | | | | | + | |
| <i>Leptanilla</i> sp. | | | | | + | |
| <i>Yavnella</i> sp. | | | | | + | |
| Subfamily Ponerinae | | | | | | |
| <i>Anochetus sedilloti</i> Emery, 1884 | + | | | | | North Africa, India |
| <i>A. traegaardhi</i> Mayr, 1904 | + | | | | | Africa |
| <i>Belonopelta loebli</i> Baroni Urbani, 1975 | + | | | | | Middle East |
| <i>Cryptopone arabica</i> n. sp. | | | | | + | |
| <i>C. ochracea</i> (Mayr, 1855) | + | | | | | Mediterranean |
| <i>Hypoponera abeillei</i> (André, 1883) | + | | | | | South Europe, North Africa |
| <i>H. eduardi</i> (Forel, 1894) | + | | | | | Mediterranean |
| <i>H. punctatissima</i> (Roger, 1859) | + | | | + | + | Cosmopolitan |
| <i>H. ragusai</i> (Emery, 1894) | + | | | | | Middle East, North Africa |
| <i>Leptogenys maxillosa</i> (Smith, 1858) | + | | | + | | Tropicopolitan |
| <i>Pachycondyla ambigua</i> André, 1890 | + | | | | | Africa |
| <i>P. sennaarensis</i> (Mayr, 1862) | + | + | + | + | + | Africa |
| <i>Platythyrea modesta</i> Emery, 1899 | + | | | + | + | Africa |
| Subfamily Cerapachyinae | | | | | | |
| <i>Cerapachys longitarsus</i> (Mayr, 1878) | + | | | | | North Africa, India |
| <i>C. wittmeri</i> Collingwood, 1985 | + | | | | | |
| <i>Cerapachys</i> sp. | | | | | + | |
| Subfamily Pseudomyrmecinae | | | | | | |
| <i>Tetraponera bifoveolata</i> (Mayr, 1895) | + | | | | + | Middle East |
| <i>T. erythraea</i> (Emery, 1895) | | | | | + | Africa |
| Subfamily Myrmicinae | | | | | | |
| <i>Aphaenogaster muschtaidica</i> Emery, 1908 | + | | | | | South Russia |
| <i>Cardiocondyla emeryi</i> Forel, 1881 | + | | | | + | Tropicopolitan |
| <i>C. gallagheri</i> n. sp. | | | | + | + | |
| <i>C. nuda</i> (Mayr, 1866) | | | | | + | North Africa, Orient |
| <i>C. shuckardi</i> Forel, 1891 | + | + | | | + | Africa |
| <i>C. wroughtonii</i> Forel, 1890 | + | | | | + | Pantropical |
| <i>C. yemeni</i> n. sp. | | | | | + | |
| <i>Crematogaster acaciae</i> Forel, 1892 | | | | + | | NE Africa |
| <i>C. aegyptiaca</i> Mayr, 1862 | + | | | + | + | North Africa |
| <i>C. affabilis</i> Forel, 1907 | + | | | + | + | NE Africa |
| <i>C. antaris</i> Forel, 1894 | + | | + | + | + | North Africa |
| <i>C. auberti</i> Emery, 1869 | + | | | | | South Europe |
| <i>C. chiarinii</i> Emery, 1881 | + | | | | + | NE Africa |
| <i>C. delagoensis</i> Forel, 1894 | | | | | + | NE Africa |
| <i>C. flaviventris</i> Santschi, 1910 | | | | | + | Africa |
| <i>C. laestrygon</i> Emery, 1869 | + | | | | + | North Africa |
| <i>C. luctans</i> Forel, 1907 | + | | | | | Africa |
| <i>C. melanogaster</i> Emery, 1895 n. stat. | | | | + | | South Africa |
| <i>C. mimosae</i> Santschi, 1914 | + | | | + | + | East Africa |
| <i>C. mosis</i> Emery, 1869 | | | + | | + | Middle East |
| <i>C. oasis</i> Santschi, 1911 | | | | + | | North Africa |
| <i>C. senegalensis</i> Roger, 1863 | + | | | + | | Africa |
| <i>Crematogaster</i> sp. A | | | | + | | |

| Genera and species | Saudi Arabia | Kuwait | U.A.E. | Oman | Yemen | Range outside Arabia |
|--------------------------------------------|--------------|--------|--------|------|-------|---------------------------|
| <i>Crematogaster</i> sp. B | | | | | + | |
| <i>Crematogaster</i> sp. C | | | | | + | |
| <i>Crematogaster</i> sp. D | | | | | + | |
| <i>Leptothorax angulatus</i> Mayr, 1862 | + | | | | + | Middle East, Africa |
| <i>L. humerosus</i> Emery, 1846 | | | | | + | NE Africa |
| <i>L. saudiae</i> n. sp. | + | | | | | |
| <i>Leptothorax</i> sp. A | | | | + | | |
| <i>Leptothorax</i> sp. B | + | | | | | |
| <i>Leptothorax</i> sp. C | + | | | | | |
| <i>Melissotarsus emeryi</i> Forel, 1907 | + | | | | + | Africa |
| <i>Messor aralocaspius</i> (Ruzsky, 1902) | + | + | | | + | Central Asia, SE Europe |
| <i>M. arenarius</i> (Fabricius, 1787) | + | + | | | | Middle East, North Africa |
| <i>M. buettikeri</i> Collingwood, 1985 | + | + | | | | |
| <i>M. ceresii</i> Santschi, 1934 | + | | | | | Middle East |
| <i>M. crawleyi</i> Santschi, 1928 n. stat. | + | | | | | Middle East |
| <i>M. decipiens</i> Santschi, 1917 | + | | | | | Africa |
| <i>M. ebeninus</i> Santschi, 1927 | + | + | + | + | + | Middle East, SE Europe |
| <i>M. foreli</i> Santschi, 1923 | + | | + | + | | North Africa |
| <i>M. galla</i> (Mayr, 1904) | + | | | + | + | Africa |
| <i>M. hismaï</i> n. sp. | + | | | | | |
| <i>M. intermedius</i> Santschi, 1927 | | | | + | | Middle East |
| <i>M. medioruber</i> Santschi, 1910 | + | + | | | | North Africa |
| <i>M. meridionalis</i> (André, 1883) | + | + | + | | | Middle East, Central Asia |
| <i>M. minor</i> (André, 1883) | + | | | | | South Europe |
| <i>M. muraywahus</i> n. sp. | + | | | | | |
| <i>M. muscatus</i> n. sp. | | | | + | | |
| <i>M. orientalis</i> Emery, 1898 | | | | | + | Middle East, Central Asia |
| <i>M. picturatus</i> Santschi, 1927 | + | + | | | | North Africa |
| <i>M. rufotestaceus</i> (Foerster, 1850) | + | | + | + | | Middle East |
| <i>M. sanganus</i> n. sp. | | | | | + | |
| <i>M. semirufus</i> (André, 1883) | | | | | + | Middle East |
| <i>M. striaticeps</i> (André, 1883) | + | + | | | | North Africa |
| <i>M. subgracilinodis</i> Arnoldi, 1969 | | | | | + | Central Asia |
| <i>M. syriacus</i> Tohmé, 1969 | + | | | | | Middle East |
| <i>M. wasmanni</i> Krausse, 1910 | | | | + | | South Europe, Middle East |
| <i>Messor</i> sp. | + | | | | | |
| <i>Monomorium abeillei</i> André, 1881 | + | + | | + | + | Middle East |
| <i>M. acutinode</i> n. sp. | | | | + | | |
| <i>M. aeyade</i> n. sp. | | | | + | | |
| <i>M. areniphilum</i> Santschi, 1911 | + | + | | + | + | Africa |
| <i>M. asiriense</i> n. sp. | + | | | | + | |
| <i>M. barbatulum</i> Mayr, 1877 | | | | + | | Central Asia |
| <i>M. baushare</i> n. sp. | + | | | | + | |
| <i>M. bicolor</i> Emery, 1877 | + | | + | | | Africa |
| <i>M. brunneolucidulum</i> n. sp. | + | | | | | |
| <i>M. buettikeri</i> n. sp. | | + | | | | |
| <i>M. buxtoni</i> Crawley, 1920 | | + | | | | Middle East |
| <i>M. carbo</i> Forel, 1910 | + | | | + | | North Africa |
| <i>M. carbonarium</i> (Smith, 1858) | | | | + | | NE Atlantic |
| <i>M. chobauti</i> Emery, 1896 | + | | + | | | Middle East |
| <i>M. clavicorne</i> André, 1883 | + | | | | | Middle East |
| <i>M. dammame</i> n. sp. | + | | | | | |
| <i>M. dentigerum</i> (Roger, 1862) | | | | + | | Middle East |
| <i>M. desertorum</i> n. sp. | + | | | | | |
| <i>M. destructor</i> (Jerdon, 1851) | + | + | | + | + | Pantropical |

| Genera and species | Saudi Arabia | Kuwait | U.A.E. | Oman | Yemen | Range outside Arabia |
|----------------------------------------------|--------------|--------|--------|------|-------|---------------------------|
| <i>M. dirie</i> n. sp. | | | | + | | |
| <i>M. fayfaense</i> n. sp. | + | | | | + | |
| <i>M. fezzanense</i> n. sp. | + | | + | + | | Middle East |
| <i>M. gallagheri</i> n. sp. | | | | + | | |
| <i>M. hanage</i> n. sp. | | | | + | + | |
| <i>M. harithe</i> n. sp. | | | | + | | |
| <i>M. hemame</i> n. sp. | | + | | | | |
| <i>M. jizane</i> n. sp. | + | | | | + | |
| <i>M. knappi</i> n. sp. | | | | | + | |
| <i>M. luteum</i> Emery, 1881 | | | | + | + | |
| <i>M. mahyoubi</i> n. sp. | | | | | + | |
| <i>M. majarishe</i> n. sp. | + | | | | | |
| <i>M. marmule</i> n. sp. | | | | + | | |
| <i>M. matame</i> n. sp. | + | | | | | |
| <i>M. mayri</i> Forel, 1902 | + | | | + | + | Cosmopolitan |
| <i>M. mintiribe</i> n. sp. | | | | + | + | |
| <i>M. montanum</i> n. sp. | + | | | | + | |
| <i>M. najrane</i> n. sp. | + | | | | | |
| <i>M. niloticum</i> Emery, 1881 | + | | | + | + | Middle East |
| <i>M. nitidiventre</i> Emery, 1893 | + | + | | | + | South Europe |
| <i>M. pharaonis</i> (Linnaeus, 1758) | + | | | | | Cosmopolitan |
| <i>M. phoenicium</i> Santschi, 1927 | + | | | + | | South Europe, Middle East |
| <i>M. qarabe</i> n. sp. | + | | | | | |
| <i>M. rimae</i> n. sp. | | | | | + | |
| <i>M. riyadhe</i> n. sp. | + | | | | | |
| <i>M. robustior</i> Forel, 1892 | | | | + | | Africa |
| <i>M. salomonis</i> (Linnaeus, 1758) | + | + | | | | North Africa |
| <i>M. subdenticorne</i> n. sp. | | | | | + | |
| <i>M. subopacum</i> (Smith, 1858) | + | | | + | + | South Europe, Africa |
| <i>M. suleyile</i> n. sp. | + | | | | | |
| <i>M. tumaire</i> n. sp. | + | | + | | | |
| <i>M. venustum</i> (Smith, 1858) | + | + | | + | | Middle East |
| <i>M. wahibiense</i> n. sp. | | | + | + | + | |
| <i>M. yemene</i> n. sp. | | | | | + | |
| <i>Oxyopomyrmex sabulonis</i> Santschi, 1915 | + | | | | | North Africa |
| <i>Pheidole jordanica</i> Saulcy, 1874 | + | | | | | Middle East |
| <i>P. katonae</i> Forel, 1907 n. stat. | + | | | | | Africa |
| <i>P. lamellinoda</i> Forel, 1802 | | | | | | Socotra, India |
| <i>P. megacephala</i> (Fabricius, 1793) | + | + | + | + | + | Cosmopolitan |
| <i>P. minuscula</i> Bernard, 1953 | + | | | | | NW Africa |
| <i>P. rugaticeps</i> Emery, 1877 | | | | + | + | NE Africa |
| <i>P. sculpturata</i> Mayr, 1866 | | | | + | + | Africa |
| <i>P. sinaitica</i> Mayr, 1862 | + | | | | + | Middle East, North Africa |
| <i>P. teneriffana</i> Forel, 1893 | + | + | | + | + | Cosmopolitan |
| <i>Pheidole</i> sp. | | | | | + | |
| <i>Solenopsis omana</i> n. sp. | | | | + | | |
| <i>S. sumara</i> n. sp. | | | | | + | |
| <i>S. zingibara</i> n. sp. | | | | | + | |
| <i>Tetramorium biskrense</i> Forel, 1904 | + | | | | | North Africa |
| <i>T. caldarium</i> (Roger, 1857) | + | | | | | Cosmopolitan |
| <i>T. calidum</i> Forel, 1907 | | | | + | | |
| <i>T. delagoense</i> Forel, 1894 | | | | | + | Middle East, Africa |
| <i>T. depressiceps</i> Menozzi, 1933 | + | | | | | Middle East |
| <i>T. doriae</i> Emery, 1881 | | | | + | + | NE Africa |
| <i>T. jizani</i> Collingwood, 1985 | + | | | | + | |

| Genera and species | Saudi Arabia | Kuwait | U.A.E. | Oman | Yemen | Range outside Arabia |
|--------------------------------------------------|--------------|--------|--------|------|-------|----------------------------|
| <i>T. juba</i> Collingwood, 1985 | + | | | | | |
| <i>T. khyarum</i> Bolton, 1980 | + | | | | + | Africa |
| <i>T. lanuginosum</i> Mayr, 1870 | + | | | | | Cosmopolitan |
| <i>T. latinode</i> n. sp. | | | | | + | |
| <i>T. sericeiventris</i> Emery, 1877 | + | + | | + | + | Africa |
| <i>T. simillimum</i> (Smith, 1851) | + | | | | + | Cosmopolitan |
| <i>T. syriacum</i> Emery, 1909 | + | | | | | Middle East |
| <i>T. turcomanicum</i> Santschi, 1921 | + | | | | | Central Asia |
| <i>T. yemene</i> n. sp. | | | | | + | |
| <i>T. zahrae</i> Santschi, 1923 | | | | | + | |
| Subfamily Dolichoderinae | | | | | | |
| <i>Tapinoma melanocephalum</i> (Fabricius, 1793) | + | + | | + | + | Cosmopolitan |
| <i>T. simrothi</i> Krausse, 1911 | + | + | | + | + | North Africa, Middle East |
| <i>Tapinoma</i> sp. | | | | | + | |
| <i>Technomyrmex albipes</i> (Smith, 1862) | + | | | | | Cosmopolitan |
| <i>T. bruneipes</i> Forel, 1895 n. stat. | | | | | + | India |
| <i>T. setosus</i> Collingwood, 1985 | + | | | + | + | |
| <i>Technomyrmex</i> sp. A | + | | | | | |
| <i>Technomyrmex</i> sp. B | + | | | | + | |
| Subfamily Formicinae | | | | | | |
| <i>Anoplolepis longitarsis</i> n. sp. | + | | | | + | |
| <i>A. tumidula</i> Emery, 1915 | + | | | | | NW Africa |
| <i>Camponotus acvapimensis</i> Mayr, 1862 | | | | + | | Socotra, Africa |
| <i>C. adenensis</i> Emery, 1893 | + | | | | + | |
| <i>C. aegyptiacus</i> Emery, 1915 | + | + | | + | + | NE Africa |
| <i>C. alii</i> Forel, 1890 | + | | | | | North Africa |
| <i>C. arabicus</i> Collingwood, 1985 | + | | | | + | |
| <i>C. atlantis</i> Forel, 1890 | + | | | | + | North Africa |
| <i>C. baldacci</i> Emery, 1894 | + | | | | | SE Europe |
| <i>C. carbo</i> Emery, 1877 | | | | + | | Africa |
| <i>C. empedocles</i> Emery, 1920 | + | | | | + | Africa |
| <i>C. fayfaensis</i> Collingwood, 1985 | + | | | | + | |
| <i>C. fellah</i> Dalla Torre, 1893 | + | + | + | + | + | North Africa |
| <i>C. flavomarginatus</i> Mayr, 1862 | + | | | + | + | East Africa |
| <i>C. foraminosus</i> Forel, 1879 | | | | + | + | Africa |
| <i>C. gallagheri</i> n. sp. | | | | + | | |
| <i>C. hova</i> Forel, 1891 | | | | + | + | Socotra |
| <i>C. ilgii</i> Forel, 1894 | + | | | | + | NE Africa |
| <i>C. jizani</i> Collingwood, 1985 | + | | | + | + | |
| <i>C. kersteni</i> Gerstaecker, 1871 | + | | | | + | East Africa |
| <i>C. maculatus</i> (Fabricius, 1781) | | | | + | + | Africa |
| <i>C. oasisum</i> Forel, 1890 | | | + | + | | Africa |
| <i>C. sericeus</i> (Fabricius, 1798) | + | + | | + | + | India, Africa |
| <i>C. somalinus</i> André, 1887 | | | | + | + | NE Africa |
| <i>C. thales</i> Forel, 1910 | + | | | | | North Africa |
| <i>C. thoracicus</i> (Fabricius, 1804) | + | + | + | | | North Africa |
| <i>C. xerxes</i> Forel, 1904 | + | | + | + | | Central Asia, Middle East |
| <i>Cataglyphis abyssinicus</i> (Forel, 1904) | + | | | + | + | North Africa |
| <i>C. acutinodis</i> n. sp. | | | | | + | |
| <i>C. adenensis</i> (Forel, 1904) | | | + | + | + | |
| <i>C. albicans</i> (Roger, 1859) | + | | | | | North Africa |
| <i>C. arenarius</i> Finzi, 1940 | | | | + | | North Africa |
| <i>C. asiriensis</i> Collingwood, 1985 | + | | | | | |
| <i>C. auratus</i> Menozzi, 1932 n. stat. | | | | + | | North Africa |
| <i>C. cinnamomeus</i> Karawaiew, 1910 | + | | + | | | Central Asia, North Africa |

| Genera and species | Saudi Arabia | Kuwait | U.A.E. | Oman | Yemen | Range outside Arabia |
|---------------------------------------------------|--------------|--------|--------|------|-------|-----------------------|
| <i>C. diehli</i> (Forel, 1902) | + | + | | + | | North Africa |
| <i>C. emmae</i> (Forel, 1909) | + | | | | | North Africa |
| <i>C. flavobrunneus</i> n. sp. | | | + | + | + | |
| <i>C. harteni</i> n. sp. | | | | | + | |
| <i>C. holgerseni</i> n. sp. | + | + | | | | |
| <i>C. isis</i> Forel, 1913 | + | | | | | Middle East |
| <i>C. laevior</i> Santschi, 1929 | + | | | | | North Africa |
| <i>C. lividus</i> (André, 1881) | + | + | + | + | + | Middle East |
| <i>C. minimus</i> Collingwood, 1985 | + | | + | | | |
| <i>C. niger</i> (André, 1881) | + | + | | + | + | Middle East |
| <i>C. opacior</i> n. sp. | | | | | + | |
| <i>C. ruber</i> (Forel, 1903) | | | | + | | North Africa |
| <i>C. sabulosus</i> Kugler, 1981 | + | | + | + | + | Middle East |
| <i>C. savignyi</i> (Dufour, 1862) | | | | + | + | North Africa |
| <i>C. semitonsus</i> Santschi, 1929 | + | | | | | Middle East |
| <i>C. shuaibensis</i> n. sp. | | | | | + | |
| <i>C. urens</i> Collingwood, 1985 | + | | + | + | + | |
| <i>C. vaucheri</i> (Emery, 1906) n. stat. | | | | + | | North Africa |
| <i>C. viaticus</i> (Fabricius, 1787) | | | + | + | | North Africa |
| <i>Cataglyphis</i> sp. | + | + | + | + | + | |
| <i>Lepisiota arabica</i> (Collingwood, 1985) | + | | | | | |
| <i>L. arenaria</i> (Arnold, 1920) | | | | + | | South Africa |
| <i>L. bipartita</i> (F. Smith, 1861) | + | | | | | Middle East |
| <i>L. canescens</i> (Emery, 1897) | + | | | + | + | NE Africa |
| <i>L. carbonaria</i> (Emery, 1892) | + | | | + | + | NE Africa |
| <i>L. dammama</i> n. sp. | + | | | | | |
| <i>L. depilis</i> (Emery, 1897) | | | | + | | NE Africa |
| <i>L. dhofara</i> n. sp. | | | | + | | |
| <i>L. dolabellae</i> (Forel, 1911) | + | | | | | Middle East |
| <i>L. erythraea</i> (Forel, 1910) | + | | | | + | NE Africa |
| <i>L. frauenfeldi</i> (Mayr, 1855) | + | | | | | South Europe |
| <i>L. gracilicornis</i> (Forel, 1892) | + | | | + | + | |
| <i>L. harteni</i> n. sp. | | | | | + | |
| <i>L. incisa</i> (Forel, 1913) | + | | | | + | Africa |
| <i>L. karawajewi</i> (Agosti & Collingwood, 1987) | | + | | | | SE Europe |
| <i>L. nigra</i> (Dalla Torre, 1893) | | | + | + | | SE Europe |
| <i>L. nigrescens</i> (Karawaiew, 1912) | | | + | | + | North Africa |
| <i>L. obtusa</i> (Emery, 1901) | + | | | + | + | NE Africa |
| <i>L. opaciventris</i> (Finzi, 1936) | + | | | + | + | Middle East |
| <i>L. riyadha</i> n. sp. | + | | | | | |
| <i>L. sericea</i> (Forel, 1892) | | | | + | | India |
| <i>L. simplex</i> (Forel, 1892) | + | | | | | Africa, India |
| <i>L. spinisquama</i> (Kuznetsov-Ugamsky, 1929) | | | | + | | Socotra, Central Asia |
| <i>L. validiuscula</i> (Emery, 1897) | | | | | + | Africa |
| <i>Lepisiota</i> sp. | | | | + | | |
| <i>Paratrechina flavipes</i> (Smith, 1874) | | | | + | | Asia |
| <i>P. jaegerskioeldi</i> (Mayr, 1904) | + | | | + | + | Cosmopolitan |
| <i>P. longicornis</i> (Latreille, 1802) | + | | | + | + | Cosmopolitan |
| <i>Plagiolepis abyssinica</i> Forel, 1894 | + | | | | | NE Africa |
| <i>P. exigua</i> Forel, 1894 | | | | | + | Africa |
| <i>P. maura</i> Santschi, 1920 | + | | | | | North Africa |
| <i>P. pygmaea</i> (Latreille, 1798) | + | | | | | South Europe |
| <i>P. schmitzii</i> Forel, 1895 | + | | | | | North Africa |
| <i>Polyrhachis lacteipennis</i> F. Smith, 1838 | + | | | + | + | India, Middle East |
| <i>P. viscosa</i> F. Smith, 1858 | | | | + | + | Africa |

SYSTEMATIC ACCOUNT

Key to subfamilies of the family Formicidae (worker caste)

- | | | |
|---|---------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|
| 1 | Eyes absent | 2 |
| — | Eyes present | 3 |
| 2 | Minute ants; TL generally less than 2.0 and HW less than 0.25. Antennae with 12 segments | Leptanillinae |
| — | Larger ants of variable size, TL from 3.0 to 9.0. Antennae with 10 or 11 segments | Dorylinae |
| 3 | Peduncle with a single node or scale | 4 |
| — | Peduncle with two distinct segments, the petiole and postpetiole | 7 |
| 4 | Gaster with a projecting sting. First and second gastral tergite with a distinct constriction between them | 5 |
| — | Gaster without a projecting sting. First and second gastral tergite not separated by a distinct constriction | 6 |
| 5 | Pygidium (last visible gastral tergite) rounded without short projecting teeth or spines. Antennal insertions concealed by frontal laminae in dorsal view | Ponerinae |
| — | Pygidium flattened, armed with very short spines or peg-like teeth. Antennal insertions not concealed by frontal laminae | Cerapachyinae |
| 6 | Apex of gaster with a circular orifice; petiole a distinct node or scale | Formicinae |
| — | Apex of gaster terminating in a transverse slit; petiole flat and reduced, overhung by the first gaster segment in Arabian species | Dolichoderinae |
| 7 | Clypeus projects back between the frontal ridges. Ocelli absent in worker caste | Myrmicinae |
| — | Clypeus does not project back between the frontal ridges but bends vertically downward in front of the head. Ocelli present and clearly visible in all castes | Pseudomyrmecinae |

Subfamily **Dorylinae**Genus *Dorylus* Fabricius, 1793

Key to species

- | | | |
|---|--------------------------------------------------------------------------------|-------------------------------|
| 1 | Funiculus segments distinctly transverse. Male petiole clearly wider than long | <i>Dorylus affinis</i> |
| — | Funiculus segments 3-6 quadrate. Male petiole almost as long as wide | <i>Dorylus fulvus</i> |

Dorylus affinis Shuckard, 1840*Dorylus affinis* Shuckard, 1840. — Ann. Nat. Hist. 5: 316.

Material: Yemen: ♂♂, ♀♀ from: Al-Mahwit, 29.IV.1991; Wadi Rima near Madinat, 12.III.1993; all A. van Harten.

Dorylus fulvus (Westwood, 1839)*Typhlopone fulvus* Westwood, 1839. — Introd. Classif. Insects 2: 219.

Dorylus fulvus. — Emery 1895; Zool. Jb. Abt. Syst. 8: 707.

Material: Yemen: ♂♂, Sana'a, IX.1991, A. van Harten; ♀♀, Madinat al-Shariq, 7.III.1993, C.A. Collingwood.

These dorylines are subterranean species not often appearing above ground. The large males fly towards light in late afternoon and early evening and are seen more often than the workers.

Subfamily Leptanillinae

Genus *Leptanilla* Emery, 1870

Leptanilla islamica Baroni Urbani, 1977

Leptanilla islamica Baroni Urbani, 1977. — Entomologica Basiliensis 2: 474.

Leptanilla sp. (Fig. 1)

Material: Yemen: ♂♂ from: Sana'a, XII.1991; Al-Kowd, II.1993; all A. van Harten.

Leptanilla species are very small narrow-bodied ants. Unassociated males fly to light. These are characterised by their small, flat, narrow heads. This is probably a new species but seems to be quite close to *L. israelis* Kugler, 1987. According to the illustration of *L. islamica*, the petiole is longer and the head broader than that of the species figured here.

Genus *Yavnella* Kugler, 1987

Yavnella sp. (Fig. 2)

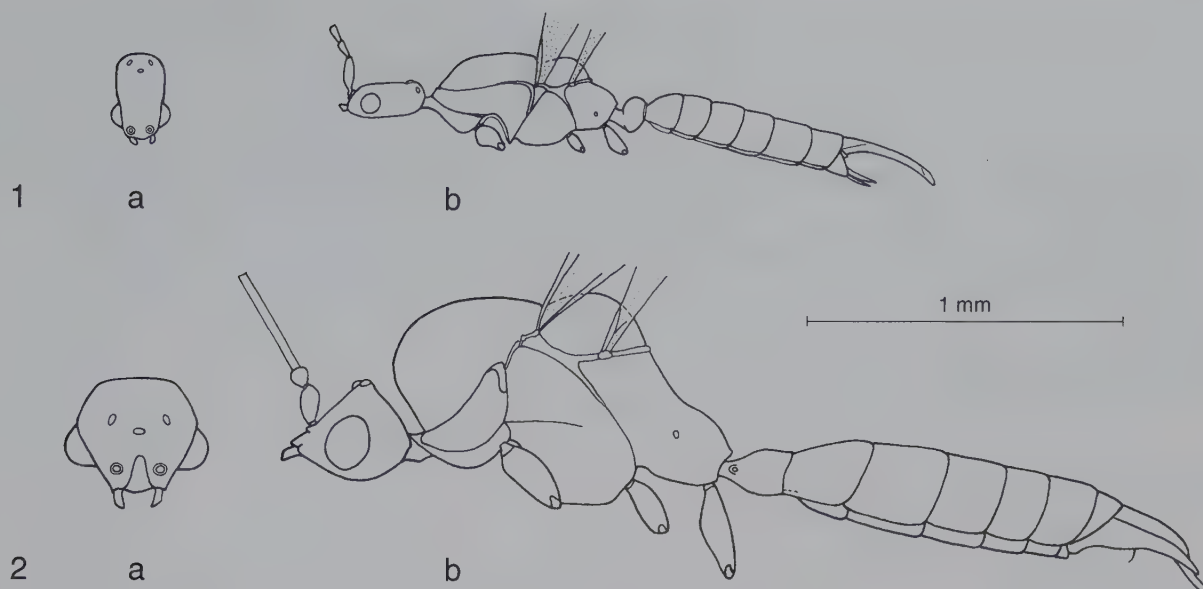
Material: Yemen: ♂♂, Sana'a, VII.1991, A. van Harten.

This genus was first recognised and established by KUGLER (1987) who described the two known species from India and Palestine respectively. The Yemen examples, taken in a light trap, have the general body shape as described by KUGLER (1987) with an expanded prothorax and cut away propodeum, wide short head, bulbous eyes, reduced wing veins and very long funiculus segments 3-12, short scapes and long legs. They appear to be different in detail from the nearest congener *Y. argami* Kugler, 1987. Queens and workers are unknown in this genus but males are quite distinct from other Leptanillinae.

Subfamily Ponerinae

Key to Arabian genera

- | | | | |
|---|-------------------------------------------------------------------------------------------------------------|--------------------|---|
| 1 | Mandibles inserted in the middle of the front margin of the head; occiput is widely emarginate | <i>Anochetus</i> | |
| — | Mandibles inserted at the sides of the front margin of the head; occiput is rounded or flat, not emarginate | | 2 |
| 2 | Mandibles falcate; tarsal claws pectinate | <i>Leptogenys</i> | |
| — | Mandibles denticulate; tarsal claws simple | | 3 |
| 3 | Middle tibiae each with two spurs | | 4 |
| — | Middle tibiae each with a single spur | | 6 |
| 4 | Middle tibia with two pectinate spurs | <i>Platythyrea</i> | |



Figs 1-2: 1, *Leptanilla* sp., ♂: a, head in dorsal view; b, profile; 2, *Yavnella* sp., ♂: a, head in dorsal view; b, profile.

- | | | |
|---|-----------------------------------------------------------------------------------------------------------------------|---------------------|
| — | Tibiae each with one pectinate and one simple spur | 5 |
| 5 | Eyes minute or absent | <i>Cryptopone</i> |
| — | Eyes distinct and moderately large | <i>Pachycondyla</i> |
| 6 | Middle tibial spur simple; mandibles long with five large teeth; clypeus produced anteriorly into a cone | <i>Belonopelta</i> |
| — | Middle tibial spur pectinate; mandibles broadly triangular; anterior margin of clypeus not produced into a sharp cone | <i>Hypoponera</i> |

Genus *Anochetus* Mayr, 1861

Key to species

- | | | |
|---|----------------------------------------------------------------------------------------------------------|------------------------------|
| 1 | Eye about 0.16 times HL. Mesonotum smooth unstriated; petiole in profile tapering to dorsal crest | <i>Anochetus traegaordhi</i> |
| — | Eye about 0.22 times HL. Mesonotum laterally striate; petiole in profile with evenly convex dorsal crest | <i>Anochetus sedilloti</i> |

Anochetus sedilloti Emery, 1884

Anochetus sedilloti Emery, 1884. — Ann. Mus. civ. Stor. nat. Giacomo Doria 21: 377.

Anochetus traegaordhi Mayr, 1904

Anochetus traegaordhi Mayr, 1904. — in Jägerskjöld: Res. Swed. Zool. Exp. Egypt White Nile 1901, 9 (Formicidae): 2.

Genus *Pachycondyla* Smith, 1858

Key to species

- 1 Robust ants with a deep mesopropodeal furrow and relatively large eyes; mandibles with a dorsolateral pit *Pachycondyla sennaarensis*
- Smaller ants with flat mesopropodeal furrow and small eyes; mandibles without a dorsolateral pit *Pachycondyla ambigua*

Pachycondyla ambigua André, 1890

Pachycondyla ambigua André, 1890. — Ann. Soc. ent. Belg. 45: 47.

Pachycondyla sennaarensis (Mayr, 1862)

Ponera sennaarensis Mayr, 1862. — Verh. zool.-bot. Ges. Wien 12: 72.

Pachycondyla sennaarensis. — André, 1890; Revue Ent. 9: 316.

Material: Oman: ♂♂, ♀♀, ♀♀ from many collections including Qarn Huwayda, Batcham, Ain Umran, Jabal Qarn, Wadi Rawbat, Wadi Khabb, Sal al-Alan, Al-Sadi, Khawr Sawli, Wadi Ma'ayadin, Madinat Qaboos, Hayl al-Awamir, Dagmar, Wadi Dharbat, 1982-1986; all M.D. Gallagher; ♀♀, Wadi Nahiz, Jabal Samhan, IX.1983, J. Darlington; ♀♀, Salahan, X.1984, J.E. Clarke. — United Arab Emirates: 1 ♀, Ras al-Kainah, 29.III.1991, C. Gross. — Yemen: ♀♀ from: Mahwit, Sana'a, Taiz, Hamamdamt, Wadi Surdud, Seyen Wadi, 1991-1992; all A. van Harten.

This species thrives around human settlements. It is a predaceous scavenger and has a powerful sting. WHITCOMBE (1982) gives a good account of this aggressive species with respect to its damage to honey bees at Khabura, Batina in Oman.

Genus *Platythyrea* Roger, 1863*Platythyrea modesta* Emery, 1899

Platythyrea modesta Emery, 1899. — Ann. Soc. ent. Belg. 43: 457.

Material: Oman: 1 ♀, Wahiba IX.1989, Ebejer. — Yemen: 1 ♀, Fona, Aden Chalet, 3.X.1988, H. Wranik; ♂♂, ♀♀ from: Al-Mahwit, 29.IV.1991; Suq Bani Mansur, 27.IV.1991; all A. van Harten.

This extends the known range in Arabia of this diurnal species.

Genus *Cryptopone* Emery, 1893

Key to species

- 1 Mandibles with five denticles *Cryptopone ochracea*
- Mandibles with twelve denticles *Cryptopone arabica* n. sp.

Cryptopone arabica n. sp.

Holotype: ♀, Yemen, Wadi Bani, 20.III.1993, C.A. Collingwood. — Paratypes: ♀♀, same series as holotype.

Measurements of holotype: TL 3.2; HL 1.12; HW 1.02; SL 0.86; EL 0.11 (eyes with 12 ommatidia).

Description: Head: long, almost straight-sided with the broadest part at the occiput which is incavate; eyes placed anteriorly well below the midline and visible in dorsal view; frontal furrow continued as a fine line to the occipital border; mandibles with a distinct dorsolateral pit, long and

curved, with 12 denticles and a large apical tooth; length from apex to clypeal border 0.42, measured along outer moderately curved edge 0.60. Frontal laminae expanded laterally, concealing antennal insertions. Scapes broadening to apex, just reaching the occipital margin when laid back.

Alitrunk: metanotal suture well developed forming a clear break dorsally between mesonotum and propodeum; promesonotal suture also visible but not breaking dorsal outline of alitrunk. Petiole squamiform with a strongly developed ventral tooth. All tibiae with one large pectinate spur and one smaller simple spur about half the length of the other. Tarsal claws simple. Whole body including head and gaster covered in pale decumbent pubescence not obscuring the underlying dilute body sculpture so that the general appearance is shining. Four to five short suberect hairs are visible on each side of the head in dorsal view with two longer hairs at the lateral clypeal corners.

Affinities: This species differs from the South European *C. ochracea* by the longer multi-dentate mandibles and overall larger body size.

Cryptopone ochracea (Mayr, 1855)

Ponera ochracea Mayr, 1855. — Verh. zool.-bot. Ges. Wien 5: 118.

Cryptopone ochracea. — Emery 1916; Boll. Soc. ent. Ital. 47: 206.

Genus *Hypoponera* Santschi, 1938

Key to species

- | | | |
|---|-------------------------------------------------------------------------------------------------|---------------------------------|
| 1 | Frontal furrow continued as a thin line to the occipital border | |
| | | <i>Hypoponera punctatissima</i> |
| — | Frontal furrow clearly not reaching the occipital border | 2 |
| 2 | Antennal scape reaches the occipital border when laid back; body colour dark | |
| | | <i>Hypoponera eduardi</i> |
| — | Antennal scape does not reach the occipital border. Body colour light yellowish brown | 3 |
| 3 | Dorsal surface of alitrunk with metanotal suture only faintly indicated | |
| | | <i>Hypoponera abeillei</i> |
| — | Dorsal surface of alitrunk interrupted by shallow but distinct metanotal suture | |
| | | <i>Hypoponera ragusai</i> |

Hypoponera abeillei (André, 1881)

Ponera abeillei André, 1881. — Bull. Soc. ent. Fr. 48: 61.

Hypoponera abeillei. — Taylor 1967; Pac. Ins. Monogr. 13: 12.

Hypoponera eduardi (Forel, 1894)

Ponera eduardi Forel, 1894. — Bull. Soc. Vaud. Sci. nat. 30: 15.

Hypoponera eduardi. — Taylor 1967; Pac. Ins. Monogr. 13: 12.

Hypoponera punctatissima (Roger, 1859)

Ponera punctatissima Roger, 1859. — Berl. ent. Z. 3: 246.

Hypoponera punctatissima. — Taylor 1967; Pacific Insects Monograph: 12.

Material: Oman: ♀♀, Thumrait, VI.1984, J.W. Barnes. — Yemen: ♀♀ from: Sana'a, VII.1991; Zabid, 26.VIII.1991; all A. van Harten.

Winged queens of this very widely distributed tramp species were taken in light traps.

Hypoponera ragusai (Emery, 1894)*Ponera ragusai* Emery, 1894. — Naturalista Sicil. Gior. Sci. nat. 14: 28.*Hypoponera ragusai*. — Baroni Urbani 1971; Mem. Soc. ent. Ital. 50: 18.

Subfamily Cerapachyinae

Genus *Cerapachys* Smith, 1857

Key to species

- 1 Apical funiculus segment swollen to form a single-segmented large club; eyes distinct but very small *Cerapachys wittmeri*
- Apical three segments together forming a club; eyes very large *Cerapachys longitarsus*

Cerapachys longitarsus (Mayr, 1878)*Lioponera longitarsus* Mayr, 1878. — Verh. zool.-bot. Ges. Wien 28:669.*Cerapachys longitarsus*. — Brown 1975; Search Agric. 5. Entomol. (Ithaca) 15: 23.*Cerapachys wittmeri* Collingwood, 1985*Cerapachys wittmeri* Collingwood, 1985. — Fauna of Saudi Arabia 7: 237.*Cerapachys* sp.

Material: Yemen: 2 ♂♂, Sana'a, VII.1991, taken at light, A. van Harten.

The two males are not at present identifiable to species.

Subfamily Pseudomyrmecinae

Genus *Tetraponera* Smith, 1852

Key to species

- 1 Alitrunk in lateral view almost flat, numerous erect hairs *Tetraponera bifoveolata*
- Alitrunk in lateral view undulate; few erect hairs on body *Tetraponera erythraea*

Tetraponera bifoveolata Mayr, 1895*Sima bifoveolata* Mayr, 1895. — Ann. naturh. Hofmus. Wien 10: 146.*Tetraponera bifoveolata*. — Wheeler 1922; Bull. Am. Mus. nat. Hist. 45: 796.

Material: Saudi Arabia: ♂♂, ♀♀ from: Wadi Tumair, 20.II.1976; Dammam, 2.IX.1976; Amjara, 19.II.1980; Wadi Sanakhab, 25.IX.1980; Khoda, 30.IX.1982; all W. Büttiker. — Yemen: 1 ♀, Al-Mahwit, 11.III.1992, A. van Harten; ♀♀, Bilad Bani, 23.III.1993, C.A. Collingwood.

This species, although taken over a wide area of Arabia, has not yet been recorded from Oman. The old record of *T. erythraea* (Emery, 1895) from Aden is still the only one for this species from the peninsula.

Subfamily Myrmicinae

Key to genera

- | | | |
|----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|
| 1 | Apical two segments of antennae forming a club. Antennae with six or ten segments | 2 |
| – | Apical three segments of antennae forming a club or antennae with four or five segments forming a somewhat indistinct club. Antennae with 11 or 12 segments . . . | 3 |
| 2 | Alitrunk box-like without dorsal sutures. Antennae with six segments | |
| | <i>Melissotarsus</i> | |
| – | Alitrunk with a distinct mesopropodeal furrow. Antennae with ten segments | |
| | <i>Solenopsis</i> | |
| 3 | Postpetiole attached mediodorsally to first gastral segment; gaster cordiform from above | |
| | <i>Crematogaster</i> | |
| – | Postpetiole attached medioventrally to first gastral segment; gaster pyriform from above | 4 |
| 4 | Antennae with four or five antennal segments slightly enlarged to form a somewhat indistinct club | 5 |
| – | Antennae with three enlarged apical segments forming a distinct club | 6 |
| 5 | Eyes large, pointed anteroventrally; antennae with 11 segments | |
| | <i>Oxyopomyrmex sabulonis</i> | |
| – | Eyes more or less rounded, not pointed anteroventrally; antennae with 12 segments . | 7 |
| 6 | Mandibles broadly rounded. Most species polymorphic with head width increasing allometrically with increased body size | |
| | <i>Messor</i> | |
| – | Mandibles triangular; monomorphic; head always longer than broad | |
| | <i>Aphaenogaster muschtaidica</i> | |
| 7 | Propodeum without spines or teeth; clypeus longitudinally bicarinate | |
| | <i>Monomorium</i> | |
| – | Propodeum bituberculate, dentate or bispinose; clypeus with median portion flat or rounded, not bicarinate | 8 |
| 8 | Clypeus raised into a ridge in front of the antennal insertions | <i>Tetramorium</i> |
| – | Clypeus not raised to a ridge in front of antennal insertions | 9 |
| 9 | Dimorphic species; major workers have greatly enlarged heads with broad mandibles of three teeth. Minor workers have narrow heads with large multidentate mandibles | |
| | <i>Pheidole</i> | |
| – | Monomorphic species; all workers in a colony of more or less even size and shape with mandibles of five teeth | 10 |
| 10 | Postpetiole enlarged, cordiform from above, in most species wider than long; alitrunk without dorsal hairs | <i>Cardiocondyla</i> |
| – | Postpetiole not conspicuously enlarged, not or scarcely wider than long; erect hairs always present on dorsum of alitrunk | <i>Leptothorax</i> |

Genus *Messor* Forel, 1890

The number of distinguishable *Messor* species in Arabia has increased from 15 to 25. This genus includes a large number of insufficiently characterised infraspecific names and in some cases wrong

attribution. Most species are polymorphic and all descriptions apply to the larger workers. Characters that are considered to be of most value include relative eye size, dorsal pilosity, especially that of the first gastral tergite, and the presence or absence of long J-shaped hairs on the ventral head surface referred to here as a psammophore, for convenience, although strictly this term should apply only to those species where these hairs are crowded. The shapes of the petiole and postpetiole are also important. Sculpture is rather variable even within the same nest series.

Messor species are seed gatherers and a useful account of foraging activity of one of the species in Yemen is given by SHEHALA (1981).

Key to species (large workers)

- | | | |
|----|--------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|
| 1 | Underside of head with moderately curved and straight hairs | 2 |
| – | Underside of head with at least some long J-shaped hairs | 3 |
| 2 | Strongly sculptured, robust, brown or brownish-black ants; propodeum angulate to broadly dentate | <i>Messor orientalis</i> |
| – | Smooth, shining, slender bicoloured ants with reddish-yellow head and alitrunk contrasting with dark gaster; propodeum with distinct small teeth | <i>Messor rufotestaceus</i> |
| 3 | First funiculus segment not longer than second; all tibial spurs pectinate | <i>Messor arenarius</i> |
| – | First funiculus segment larger and distinctly longer than second; mid and hind tibial spurs simple | 4 |
| 4 | First gaster tergite conspicuously hairy with long pale hairs | 5 |
| – | First gaster tergite with short hairs, few or none | 9 |
| 5 | Head red or dark red contrasting with dark alitrunk and gaster; maximum HW over 3.0 | <i>Messor decipiens</i> |
| – | Head dark as gaster; maximum HW 2.5 or less | 6 |
| 6 | Eyes large, 0.25 times HW. Propodeal outline smoothly rounded | <i>Messor buettikeri</i> |
| – | Eyes smaller, 0.21 times HW or less. Propodeal outline more or less angulate or dentate | 7 |
| 7 | Propodeum with projecting blunt teeth | <i>Messor muraywahus</i> n. sp. |
| – | Propodeum simply angulate, not dentate | 8 |
| 8 | Dorsum of head finely striated; alitrunk dark | <i>Messor aralocaspius</i> |
| – | Head smooth unsculptured; alitrunk often slightly reddish | <i>Messor subgracilinodis</i> |
| 9 | Unicolorous dark brown to black ants | 10 |
| – | Bicoloured ants with head and/or alitrunk reddish contrasting with dark gaster | 15 |
| 10 | Propodeum armed with spines or teeth | 11 |
| – | Propodeum angulate or rounded | 13 |
| 11 | Head completely striated; alitrunk sculptured | <i>Messor striaticeps</i> |
| – | Head and alitrunk smooth with superficial sculpture | 12 |
| 12 | Eyes large, 0.3 times HW. Propodeum with short broad-based teeth | <i>Messor foreli</i> |
| – | Eyes smaller, less than 0.20 times HW. Propodeum with distinct spines | <i>Messor hismai</i> n. sp. |
| 13 | Eyes large, 0.3 times HW. Scapes long surpassing occiput, SI over 100. Propodeum smoothly rounded | <i>Messor muscatus</i> n. sp. |

- Eyes smaller, 0.25 times HW or less. Scapes shorter, SI 80 or less. Propodeum angulate 14
- 14 Postpetiole long and low without an anteroventral projection. Occiput with 7-8 projecting hairs at each side of the midline *Messor crawleyi*
- Postpetiole a rounded node with an anteroventral projection. Occiput with 3-5 projecting hairs at each side of the midline *Messor ebeninus*
- 15 Head of larger workers red or reddish, distinctly lighter than the gaster 16
- Head dark, unicolorous with the gaster; alitrunk paler, reddish at least in part 21
- 16 Maximum HW 2.0 or less 17
- Maximum HW 2.5 or more 19
- 17 Head wholly or in part smooth and shining; propodeal outline rounded *Messor minor*
- Head completely sculptured; propodeum angled 18
- 18 Head coarsely striate, subrectangular; head, alitrunk and nodes entirely reddish *Messor ceresis*
- Head finely striated with occiput smoothly rounding into the broadly rounded sides; alitrunk and nodes in part brownish *Messor picturatus*
- 19 Dark species with head only slightly reddish; postpetiole in dorsal view slightly longer than wide, without a distinct anteroventral projection *Messor sanganus* n. sp.
- Head and alitrunk red; postpetiole not longer than wide with a distinct anteroventral projection 20
- 20 First gaster tergite smooth and shining without any dorsal hairs *Messor galla*
- First gaster tergite with superficial sculpture and always with a few to several suberect hairs *Messor semirufus*
- 21 Propodeal outline smoothly rounded; ventral J-shaped hairs profuse forming a distinct psammophore; eyes large, 0.25 times HW *Messor syriacus*
- Propodeal profile more or less angulate; ventral J-shaped hairs fewer, not forming a distinct psammophore; eyes smaller, 0.15-0.22 times HW 22
- 22 Gaster with many suberect hairs; occiput with 5-8 projecting hairs at each side of the midline *Messor medioruber*
- Gaster with occasional suberect hairs or none; occiput with 3 or 4 hairs at most projecting at each side of the midline 23
- 23 Eyes large, always more than 0.20 times HW *Messor meridionalis*
- Eyes smaller, 0.14-0.19 times HW 24
- 24 Pronotum somewhat flattened with lateral bosses clearly visible in oblique view; alitrunk at least in part reddish and well contrasted with dark gaster; head somewhat shining *Messor wasmanni*
- Pronotum simply rounded; alitrunk only slightly paler than gaster; head dull with fine sculpture *Messor intermedius*

Messor aralocaspius (Ruzsky, 1902)

Aphaenogaster barbara var. *aralocaspius* Ruzsky, 1902. — Izvest. Turk. Otd. Imp. Russk. Geog. Obshch. 3: 20.

Messor aralocaspius. — Pisarski 1967; Ann. zool. Warsz. 24 (6): 384.

Material: Saudi Arabia: ♀♀, Jeddah-Taif, 1200 m, 1.V.1979, Exp. N. Hedjaz (W. Büttiker); ♀♀, Wadi Khumra, 10.II.1978, W. Büttiker. — Kuwait: 1 ♀, Al-Rileg al-Shamali, 26.III.1988, W. Büttiker. — Yemen: 1 ♀, ♀♀, Sana'a, 7.XII.1990, A. van Harten; ♀♀, Djebel an-Nir Shuaib, 3000 m, 6.III.1993, C.A. Collingwood.

Measurements: HW 1.9-2.4; EL/HW 0.19-0.23.

The head is strongly striate and the whole of the alitrunk dorsum is transversely striate. All dorsal surfaces are covered with long pale hairs. The psammophore is moderately developed, never thick. The propodeum is angulate in profile but never dentate or spined. This is generally a highland species in Arabia and constructs relatively large crater nests.

***Messor arenarius* (Fabricius, 1787)**

Formica arenaria Fabricius, 1787. — Mant. Insect. 1: 30.

Messor arenarius. — Forel 1894; Bull. Soc. Vaud. Sci. nat. 30: 45.

Material: Saudi Arabia: ♀♀ from: Wadi Durmah, 30.XII.1975; Dammam, 14.V.1976; Riyadh, 29.III.1976; all W. Büttiker. — Kuwait: ♀♀, Al-Jawf, 2.XI.1986, W. Büttiker.

Measurements: HW 3.4-4.5; EL/HW 0.165.

This is by far the largest *Messor* species in the Middle East. The subcephalic hairs are numerous but do not form a distinct psammophore. All body surfaces are covered with erect hairs. The propodeum is armed with short strong spines. The general body colour is brownish black but the alitrunk is occasionally somewhat reddish and such examples appear little different from *M. regalis* (Emery, 1892) of sub-Saharan Africa, sharing the same features: short first funiculus segment, pectinate tibial spurs, thick body pilosity, spined propodeum and rugose body sculpture extending to the first gastral tergite.

***Messor buettikeri* Collingwood, 1985**

Messor buettikeri Collingwood, 1985. — Fauna of Saudi Arabia 7: 249.

Material: Kuwait: 6 ♀♀, Aqabat al-Khuraytah, 15.IV.1984, W. Büttiker.

Measurements: HW 1.64; EL/HW 0.24-0.26.

The sample of workers of this smooth-sculptured, black, large-eyed species have the features as described in COLLINGWOOD (1985). A further character is the postpetiole which has the ventral surface flat without an anterior projection.

***Messor ceresis* Santschi, 1934**

Messor ceresis Santschi, 1934. — Bull. Ann. Soc. ent. Belg. 74: 274.

Material: Saudi Arabia: ♀♀ from: Diriyah, 28.III.1975; Wadi Tumair, 13.II.1976; Wadi Hanifa, 18.II.1976; all W. Büttiker.

Measurements: HW 1.3-1.5; EL/HW 0.20-0.223.

This is a small apparently monomorphic red species resembling some forms of *M. minor* (André, 1882), differing in the coarser sculpture of the head and alitrunk, slightly larger eyes, stronger development of the psammophore, distinctly angulate propodeum and less variable size. There are 0-2 projecting hairs at each side on the occiput, two pairs each on the pronotum, petiole and postpetiole with a few hairs at the distal margin of the first gastral tergite. Head, alitrunk and nodes are entirely reddish. The species was described from Lebanon and is evidently rather local.

***Messor crawleyi* Santschi, 1928; n. stat.**

Messor rugosus st. *crawleyi* Santschi, 1928. — Rev. Zool. Bot. Afr. 16: 203.

Material: Saudi Arabia: 1 ♀, Wadi Tumair, 20.II.1976, W. Büttiker.

Measurements: HW 1.52; SL 1.24, EL 0.38; EL/HW 0.249.

This is a large-eyed, small brown sculptured species. The propodeum is sharply angulate with the flat dorsal surface meeting the down slope at a near right angle. The petiole is somewhat thick with a rounded dorsal crest. The postpetiole is low without a ventral projection. The head has the frons striate with the striae extending across to the eyes. The pronotum and the propodeum are

strongly transversely striate; the mesonotum has strong longitudinal striae curving in towards the well-marked promesonotal suture. Both nodes have close reticulopunctate sculpture while the gaster is smooth and glossy. The psammophore is well developed. The occiput has 7-8 hairs at each side of the midline and the alitrunk dorsum has many scattered hairs with two pairs on the propodeum, two pairs on the petiole and three on the postpetiole. At least 12 standing hairs are visible on the first gastral tergite in profile. This species differs from *M. rugosus* (André, 1881) of the Middle East in the distinctly angulate propodeum, sparser pilosity, more striated alitrunk and smoother gaster.

Messor decipiens Santschi, 1917

Messor capensis st. *decipiens* Santschi, 1917. — Bull. Soc. Hist. nat. Afr. 8: 94.

Messor decipiens. — Bolton 1982; Bull. Br. Mus. nat. Hist. 45 (4): 348.

Material: Saudi Arabia: ♀♀, Thanomah, 10.IV.1980, W. Büttiker.

Measurements: HW 2.54-2.76; EL/HW 0.20-0.21.

This species, well characterised by BOLTON (1982), has similar body pilosity to *M. aralocaspius* but is much larger. The previous record, Anamas (COLLINGWOOD 1985), is in the same general area of the Asir highlands as Thanomah.

Messor ebeninus Santschi, 1927

Messor semirufus var. *ebeninus* Santschi, 1927. — Bol. R. Soc. esp. Hist. nat. 27: 229.

Messor ebeninus. — Tohmé 1971; Bull. Soc. ent. Egypte 54: 569.

Material: Saudi Arabia: ♀♀, ♀♀ from: Diriyah, 18.III.1975; Uyaynah, IV.1976; Mizbil, XII.1977; Wadi Awsat, XII.1976; Wadi Khumra, 18.IV.1976; Wadi Hanifa, 28.XI.1977; Jebel Banban, 5.II.1979; Wadi Daykah, IV.1980; Wadi Karrar, I.1979; Harram, 24.XI.1981; all W. Büttiker. — Kuwait: ♀♀, Aqabat al-Khuraytah, 7.IV.1980, W. Büttiker. — United Arab Emirates: ♀♀, Djebel Haffete, X.1989, H. Heatwole; ♀♀, Ras Ghanada, IX.1992, B. Tigar. — Oman: ♀♀, Khasab Musandham, 15.IV.1986, R. Braund. — Yemen: ♀♀ from: Wadi Surdah, 21.IX.1991; Sana'a, 5.I.1992; all A. van Harten; ♀♀, Taiz – Al-Turbah, 14.III.1993, C.A. Collingwood.

Measurements: HW 2.0-2.5; EL/HW 0.19-0.23.

This evenly black species has a rather variable pilosity with 1-5 hairs at each side on the occiput, 1-2 pairs on the propodeum, one pair each on the petiole and postpetiole and there are a few occasional hairs on the first gastral tergite.

Messor foreli Santschi, 1923 (Fig. 3)

Messor aegyptiacus var. *foreli* Santschi, 1923. — Rev. Suisse Zool. 30: 322.

Messor foreli. — Bernard 1981; Syst. Assoc. Spec. 19: 143.

Material: Saudi Arabia: ♀♀ from: Dammam, 18.VIII.1976; Hofuf Road, E of Riyadh, 21.III.1975; all W. Büttiker. — United Arab Emirates: ♀♀, Ras Ghanada, IX.1992, B. Tigar. — Oman: ♀♀, Wadi Andam, II.1986, W. Büttiker; ♀♀, misidentified as *M. planiceps* Stitz, 1917 in COLLINGWOOD (1988), Ras al-Jibsh, 6.III.1987, M.D. Gallagher.

Measurements: HW 1.35-1.39; SI 94; EL/HW 0.30.

This is a small species characterised by its large eyes, dentate propodeum and hairless propodeum, nodes and first gastral tergite. The colour is evenly reddish brown to brownish black and the sculpture is dilute with the whole body shining. The postpetiole is rather low and slightly truncate. It is a true desert species common in the northern Sahara.

Messor galla (Mayr, 1904)

Stenamma (Messor) barbarum var. *galla* Mayr, 1904. — in Jägerskjöld: Res. Swed. Zool. Exp. Egypt White Nile 1 (6): 5.

Messor galla. — Santschi 1928; Rev. Zool. Bot. Afr. 16: 201.

Material: Oman: ♀♀, Jabal Qarms Musandham, IX.1982, R. Braund; ♀♀ from: Khadrafi Dhofar, 27.IX.1983; Marmul Dhofar, 25.IX.1984; Ayum Pools, 27.IX.1983; Wadi Sayq, 24.IX.1983; all J. Darlington. — Yemen: ♀♀, Madinat al-Shariq, 7.III.1993, C.A. Collingwood.

Measurements: HW 2.84; EL/HW 0.17-0.19.

This subtropical species is evidently common in the cultivated valleys of the Dhofar. It appears to be uncommon in Yemen and in Saudi Arabia was not found further north than the sheltered valleys at Fayfa near the Yemen border.

Messor hismai n. sp. (Fig. 4)

Holotype: ♀, Saudi Arabia, Wadi Hisma, 28°02'N 36°07'E, 1120 m, W. Büttiker. — Paratypes: 5 ♀♀, same series as holotype.

Measurements of holotype: TL 5.32; HL 1.20; HW 1.28; SL 1.20; EL/HW 0.19.

Description: This is a small, dark, apparently monomorphic species with distinct propodeal spines. The whole of the alitrunk dorsum has reticulopunctate sculpture but the nodes and gaster are smooth and glossy black. There are no dorsal hairs on the propodeum or nodes. There are some short hairs on the genae and the gaster with a few longer hairs on the posterior tergite border.

Affinities: This species is similar to *M. foreli* but has distinct propodeal spines and a generally darker colour.

Messor intermedius Santschi, 1927

Messor semirufus var. *intermedius* Santschi, 1927. — Bol. R. Soc. esp. Hist. nat. 27: 229.

Messor intermedius. — Arnoldi 1977; Zool. Z. H. 36: 437.

Material: Saudi Arabia: ♀♀, Wadi al-Ammariyah, 3.II.1977, W. Büttiker.

Measurements: HW 2.78; EL/HW 0.16-0.17.

This is a brown species with the alitrunk sometimes dark red but never as dark as the gaster. It resembles *M. semirufus* in the relatively small eye size but is distinguished by the coarse sculpture and much darker colour. It has a rather local distribution in the Middle East.

Messor medioruber Santschi, 1910

Messor medioruber Santschi, 1910. — Bull. Soc. Hist. nat. Afr. Nord 2: 44.

Material: Kuwait: ♀♀ from: Wafra, III.1988; Sulabiyah, 10.III.1988; all W. Büttiker.

Measurements: HW 2.0; EL/HW 0.245.

This bicoloured species differs from *M. meridionalis* by the numerous dorsal hairs over the alitrunk and gaster and the shape of the postpetiole which has a flat ventral surface without a protruding process when viewed in full profile.

Messor meridionalis (André, 1883) (Fig. 5)

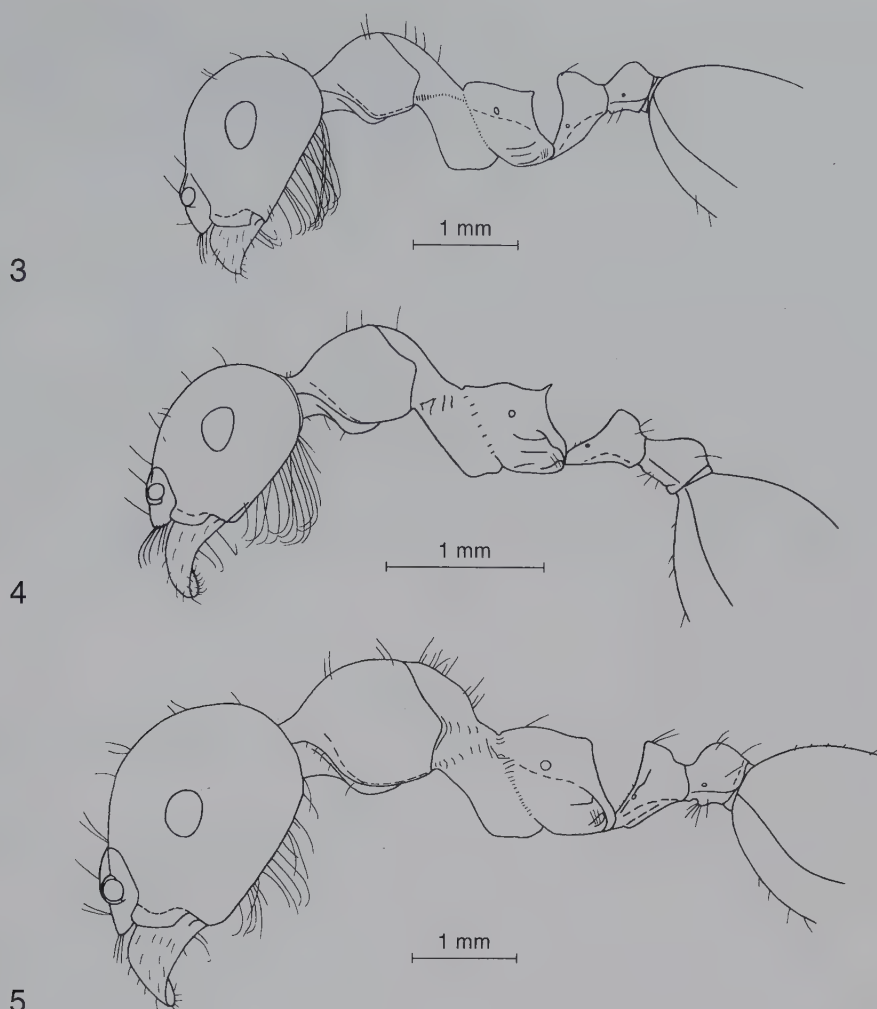
Aphaenogaster barbara var. *meridionalis* André, 1883. — Spec. Hym. Europe 2: 353.

Messor meridionalis. — Bondroit 1918; Ann. Soc. ent. Fr. 67: 155.

Material: Saudi Arabia: ♀♀, ♀♀ from: Diriyah, 28.III.1975; Riyadh Wireless Station, 9.II.1976; Dammam, 28.VIII.1976; Wadi Hanifa, 12.XII.1975; Wadi Durmah, 22.XII.1985; all W. Büttiker. — Kuwait: ♀♀ from: Failaka Island, 31.III.1988; Salubiyah, 16.II.1988; all W. Büttiker. — Oman: ♀♀, Jiddat al-Sahara 23.IV.1989, M.D. Gallagher.

Measurements: HW 2.3-2.6; EL/HW 0.204-0.223.

This bicoloured species known from Afghanistan (PISARSKI 1967) and most of the countries of the Middle East including Iraq and Iran is immediately distinguishable from *M. semirufus*, *M. wasmanni* and other superficially similar species by its relatively large eyes. In museum collections several different species are placed under the name *M. meridionalis* so that there is uncertainty as to which species this name should apply. The nearest similar species in the Santschi collection in NHMB is *M. grandinida* Santschi, 1910.



Figs 3-5: Head and alitrunk in profile: 3, *Messor foreli*, ♀; 4, *M. hismai* n. sp., ♀; 5, *M. meridionalis*, ♀.

Messor minor (André, 1883)

Aphaenogaster barbara var. *minor* André, 1883. — Spec. Hym. Europe 2: 253.

Messor minor. — Kutter 1927; Folia Myrm. Term. 1: 99.

Material: Saudi Arabia: ♀♀, Wadi Shuqub, 7.IV.1983, C.A. Collingwood.

Measurements: HW 1.8-2.4; EL/HW 0.18-0.22.

This red-headed species occurs in South Italy and Tunisia and seems to be indistinguishable from *M. maurus* Barquin, 1981 from Tenerife and Lanzarote. It is known in Arabia only from a restricted area of the Asir highlands.

Messor muraywahus n. sp. (Fig. 6)

Holotype: ♀, Saudi Arabia, Al-Muraywah, 28°45'N 44°00'E, 28.X.1986, W. Büttiker. — Paratypes: 2 ♀♀, same series as holotype.

Measurements of holotype: TL 6.5; HL 2.1; HW 2.2; SL 1.91; EL/HW 0.232.

Description: This species is similar to *M. aralocaspius* but the body hairs are shorter and differently distributed. The occiput has four and five projecting hairs at each side of the midline. Short hairs project on the genae below the eyes. The pronotum has several long dorsal hairs, the petiole one pair and the postpetiole two pairs. Several short hairs are present over the first gastral

dorsum. This species has relatively larger eyes than *M. aralocaspius*, a steeper more sharply angled petiole and the propodeum is armed with slightly projecting blunt teeth. The subcephalic hairs are sparse, not forming a distinct psammophore. The head is moderately shining with a few scattered punctures, the alitrunk dorsum is transversely striate and the gaster has fine superficial sculpture.

Messor muscatus n. sp. (Fig. 7)

Holotype: ♀, Oman, Ras al-Hamra, Muscat, 19.VI.1985, C. Holzschuh. — Paratypes: Oman: 1 ♀, same series as holotype. — Saudi Arabia: 1 ♀, Wadi Shijah, 4.V.1976, W. Büttiker. — Yemen: 2 ♀♀, Madinat al-Shariq, 7.III.1993, C.A. Collingwood.

Measurements of holotype: TL 5.2; HW 1.11; EL/HW 0.31; SI 103.

Description: This small brown species has large eyes and a long scape which surpasses the occiput when laid back. The propodeum is rounded as in *M. syriacus*. The psammophore is distinct but less developed compared with *M. syriacus* and the whole body is evenly brownish, not bicoloured as in *M. syriacus*. The postpetiole is long and low as in *M. crawleyi* and *M. hismai* but this species is distinctly different from both of these in the shape of the propodeum. There are long body hairs over the promesonotum and a few shorter hairs on the first gastral tergite.

Messor picturatus Santschi, 1927

Messor instabilis picturatus Santschi, 1927. — Rev. Suisse Zool. 30.

Messor picturatus. — Collingwood 1985; Fauna of Saudi Arabia 7: 251.

Material: Saudi Arabia: ♀♀ from: Wadi Salbukh, 8.IX.1977; Wadi Hanifa, 3. and 8.II.1976; all W. Büttiker. — Kuwait: ♀♀, Anwha Island, 29.II.1988, W. Büttiker.

Measurements: HW 1.92-2.12; EL/HW 0.21-0.23.

This species has the red head and alitrunk of the *M. minor* species group but differs in the more rounded head, grainy head and stronger alitrunk sculpture. This is particularly evident in the larger examples. Small workers are hard to tell apart except for the larger eyes. The petiole in *M. picturatus* is also thicker compared with similar sized examples of *M. minor* and the anteroventral prominence on the postpetiole is more developed. *M. minor* examples from Corsica and what appears to be the same species from Tenerife have a few erect hairs on the first gastral tergite. These are restricted to two or three on the posterior margin of the first tergite in *M. picturatus*.

Messor rufotestaceus (Foerster, 1850)

Myrmica rufotestacea Foerster, 1850. — Verh. naturh. Ver. preuss. Rheinl. 74: 89.

Messor rufotestaceus. — Emery 1908; Dt. ent. Z. (1908): 437.

Material: Saudi Arabia: ♀♀ from: Riyadh, 20.II.1975; Wadi Harth, 28.IX.1978; Wadi Tabuk, 24.IV.1979; all W. Büttiker. — United Arab Emirates: ♀♀, Ras Ghanada, IX.1992, B. Tigar. — Oman: ♀♀, Kuria Muria, 24.IV.1984, J. Darlington; 1 ♀, Baushar, W of Muscat, X.1985, M.D. Gallagher.

Measurements: HW 1.7; EL/HW 0.21.

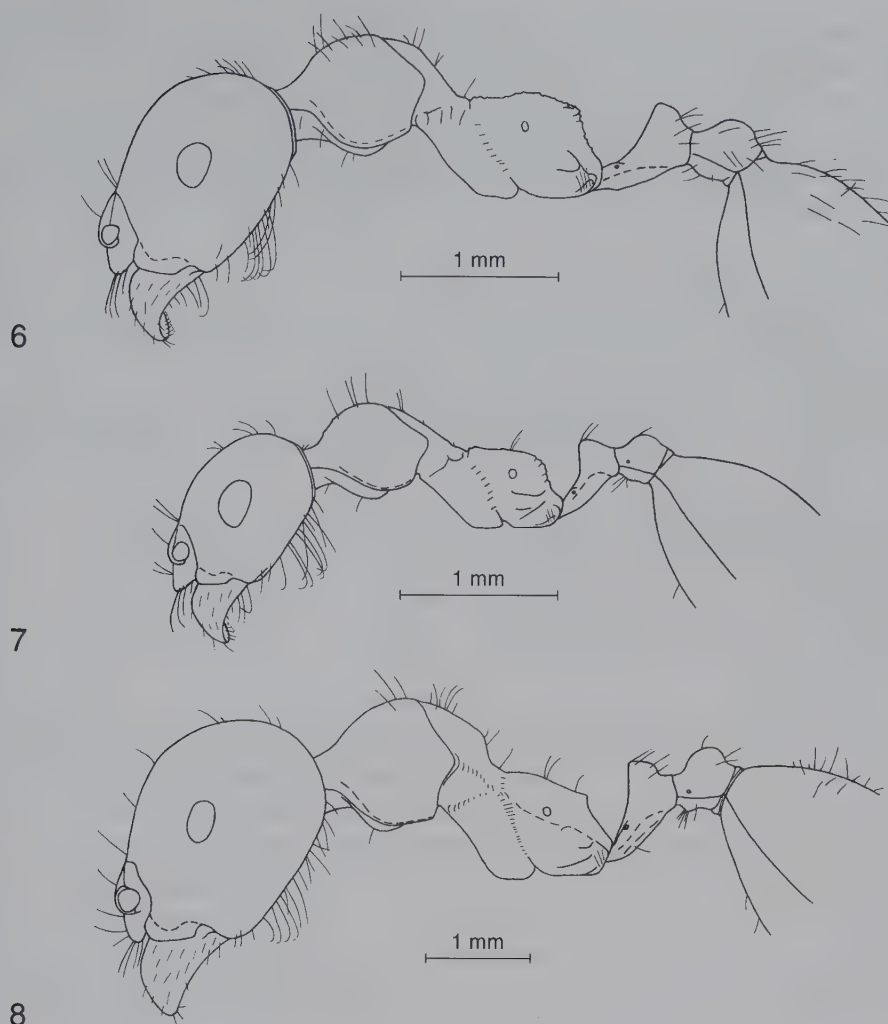
This interesting species stands apart from other Middle Eastern *Messor* species because the antennal segments are exceptionally thin and the nodes are comparatively low. It is a non-trail-forming species living in small communities. It is known from Syria, Palestine and the northern Sahara.

Messor sanganus n. sp.

Holotype: ♀, Yemen, Sangani Pass, 13.III.1993, 2200 m, C.A. Collingwood. — Paratypes: 19 ♀♀, same series as holotype.

Measurements of holotype: TL 7.5; HL 2.28; HW 2.28; EL/HW 0.19.

Description: Head shining, dark red, contrasting with dark alitrunk and gaster. Whole of alitrunk dorsum finely transversely striate. Petiole dorsum sculptured; postpetiole and gaster



Figs 6-8: Head and alitrunk in profile: 6, *Messor muraywahus* n. sp., ♀; 7, *M. muscatus* n. sp., ♀; 8, *M. wasmanni*, ♀.

smooth and shining with some superficial sculpture. The propodeal profile is steeply rounded but not angulate; the petiole is a rounded triangle and the postpetiole is simple, without a distinct anteroventral projection as seen in profile and very slightly longer than broad in dorsal view. The alitrunk has several hairs, the petiole and postpetiole each have two pairs and the first gaster tergite has seven visible in full profile. This species differs from *M. semirufus* in the much darker body colour, slightly larger eyes and the longer lower postpetiole. The ants were taken from a large populous nest in a sun-exposed sheltered part of the high pass.

Messor striaticeps (André, 1883)

Aphaenogaster barbara var. *striaticeps* André, 1883. — Spec. Hym. Europe 2: 356.

Messor striaticeps. — Cagniant 1969; Bull. Soc. Hist. nat. 105: 405.

Material: Saudi Arabia: ♀♀, Tabuk, 13.XI.1988, W. Büttiker. — Kuwait: ♀♀, Al-Jawf, 2.XI.1986, W. Büttiker.

Measurements: HW 2.46; EL/HW 0.205-0.21.

This species is totally black with a strongly striated head and well-developed propodeal spines. The psammophore is weakly developed.

Messor subgracilinodis Arnoldi, 1969

Messor subgracilinodis Arnoldi, 1969. — Zool. Zhurn. 49: 73.

Material: Yemen: ♀♀, Al-Mahwit, above 2000 m, 21.X.1991, A. van Harten.

Measurements: HW 2.48; EL/HW 0.17.

This species has body pilosity much as *M. aralocaspius* but less dense and it also differs by the much smoother head sculpture, smaller eyes and the frequent slightly reddish tinge to the alitrunk.

Messor syriacus Tohmé, 1969

Messor syriacus Tohmé, 1969. — Publ. Univ. Liban Sci. nat. 7: 9.

Material: Saudi Arabia: ♀♀ from: Wadi Durmah, 16.I.1976; Al-Khubra, 22.V.1977; all W. Büttiker.

Measurements: HW 1.7-2.3; EL/HW 0.24-0.28.

This species has large eyes and a well-developed psammophore. The propodeum is rounded in profile, not angulate.

Messor wasmanni Krausse, 1910 (Fig. 8)

Messor barbarus wasmanni Krausse, 1910. — Zool. Anz. 35: 524.

Messor wasmanni. — Casevitz-Weulersse 1990; Bull. Mus. natn. Hist. nat. 12: 154.

Material: Oman: ♀♀, Dharbat Falls, 13.II.1986, M.D. Gallagher.

Measurements: HW 2.5-2.9; EL/HW 0.16-0.19.

This species differs from *M. semirufus* and related species by the shape of the pronotum which is mildly flattened dorsally and expanded laterally into a protuberant boss at each side. This is a constant and characteristic feature and most easily seen in slanted profile. It is a very common grain-harvesting ant found on all of the Greek islands, on the southern Balkan mainland, in South Italy and the Mediterranean islands of Corsica, Sardinia and Sicily but not in Malta or the Balearics. It has also been taken locally in Tunisia but its occurrence so far south as Oman is a surprise. However, TOHMÉ (1968) and TOHMÉ & TOHMÉ (1981) recorded it as *M. concolor* Emery, 1908 from Lebanon and Syria respectively. Specimens labelled *M. concolor* cotype in both the Oxford Hope Museum and the NHMB are confirmed as *M. wasmanni*, *M. concolor* being a junior synonym.

Messor sp.

Material: Saudi Arabia: 1 ♀, Harithi, 19.IV.1985, W. Büttiker.

A single worker resembling *M. muraywahus* n. sp. in general shape, differs in the near absence of long subcephalic hairs. Since this may be due to abrasion and in the absence of further specimens, no formal description is given.

Genus *Pheidole* Westwood, 1839

Key to species (large workers)

- | | | | |
|---|----------------------------------------------------------------------------------------------------|-----------------------------|---|
| 1 | HW less than 1.0; head clearly longer than wide | <i>Pheidole minuscula</i> | |
| — | HW more than 1.35; head sides curved, head not or scarcely longer than broad . . . | | 2 |
| 2 | Petiole with a ventral projection, in profile a translucent lobe | <i>Pheidole lamellinoda</i> | |
| — | Petiole without a ventral projection. | | 3 |
| 3 | Postpetiole wider than long, distinctly dentate at widest point | | 4 |
| — | Postpetiole scarcely or not wider than long, rounded or at most slightly angled at sides | | 7 |

- 4 Promesonotal outline evenly curved without a distinct dorsal prominence; funiculus segments 2, 3 and 4 quadrate *Pheidole megacephala*
- Promesonotal outline broken by distinct dorsal ridge or prominence; funiculus segments 2, 3 and 4 longer than wide 5
- 5 Head completely striate to occiput; postpetiole about twice as wide as long *Pheidole teneriffana*
- Head with median occipital area smooth; postpetiole about three times as wide as long 6
- 6 Legs and antennae clothed with erect pubescence; head sculpture strong *Pheidole sculpturata*
- Appendage pubescence subdecumbent; head sculpture weak *Pheidole katonae*
- 7 HW more than 2.0; sides of head striate to occiput; first gaster tergite partially or totally striate *Pheidole rugaticeps*
- HW 1.6 or less; occipital lobes without striae; first gaster tergite smooth 8
- 8 Postpetiole slightly longer than broad about 0.2 times HW; funiculus segment 2 scarcely longer than wide *Pheidole jordanica*
- Postpetiole about as wide as long, 0.23 times HW; funiculus segment 2 slightly longer than wide *Pheidole sinaitica*

Pheidole jordanica Saulcy, 1874

Pheidole jordanica Saulcy, 1874. — Bull. Soc. Hist. nat. Moselle 13: 17.

Measurements: SI 0.675; HW/PPW 0.227.

This is a fairly common species in the Middle East and occurs also in north-eastern Africa.

Pheidole katonae Forel, 1907; n. stat.

Pheidole sculpturata katonae Forel, 1907. — Ann. hist.-nat. Mus. natn. Hung. 5: 21.

Pheidole sculpturata. — Collingwood 1985; Fauna of Saudi Arabia 7: 255, pro parte [misidentification].

Material: Saudi Arabia: ♀♀, Fayfa, 27.III.1983, C.A. Collingwood (recorded as *P. sculpturata*). — Oman: ♀♀, Tanuf, 11.XI.1977, R.P. Whitcombe; ♀♀ from: Thumrait, 20.I.1984; Samhan, 25.IV.1984; Jabal Akhdar, 13.X.1984; Dibab, IX.1985; Ras Madrasah, 1.X.1986; all M.D. Gallagher.

Measurements: SI 0.5; HW/PPW 0.313.

The head shape of the large workers is similar to that of *P. sculpturata* but the reduced head sculpture and less abundant oblique appendage pubescence justify specific distinction.

Pheidole megacephala (Fabricius, 1793)

Formica megacephala Fabricius, 1793. — Ent. Syst. 2: 361.

Pheidole megacephala. — Roger 1863; Verz. Formicid.: 30.

Material: Saudi Arabia: ♀♀ from: Bani Rizam, 9.IX.1987; Harithi, 19.IX.1987; all W. Büttiker. — Kuwait: ♀♀, Sulabiyah, 16.II.1988, W. Büttiker. — Oman: ♀♀ from: Wadi Halet, 25.IX.1984; Jabal Samhan, 20.IX.1984; all M.D. Gallagher. — Yemen: ♀♀, Qa a Boun, 18.X.1991, M. Knapp; ♂♂, ♀♀, ♀♀ from: Al-Mahwit, 21.IX.1991; Sana'a, VIII.1991; Wadi Hami, 17.VIII.1991; Hammam Ali, 6.VIII.1991; all A. van Harten; ♀♀, Materlik Laboratory, V.1986, H. Wranik.

Measurements: SI 0.47; HW/PPW 0.34.

This is a common tramp species. Its origin is not known.

Pheidole rugaticeps Emery, 1877

Pheidole rugaticeps Emery, 1877. — Ann. Mus. civ. Stor. nat. Genova 9: 375.

Material: Oman: ♀♀ from: Am Umrán, 15.IX.1982; Dharbat Falls, 13.II.1984; Bani Habil, 22.X.1984; all M.D. Gallagher; ♀♀ from: Sudha, 15.X.1984; Atsah, 21.IX.1984; all J. Darlington. — Yemen: ♀♀, Al-Mahwit, 7.III.1993, C.A. Collingwood.

Measurements: SI 0.543; HW/PPW 0.274.

EMERY (1881) described a variety, *P. rugaticeps* var. *arabs*, with smoother head sculpture from Yemen. All the examples from Yemen have somewhat smoother head sculpture than named examples in NHMB from north-eastern Africa but there is no other difference between the two forms.

Pheidole sculpturata Mayr, 1866

Pheidole sculpturata Mayr, 1866. — Verh. zool.-bot. Ges. Wien 16: 897.

Material: Oman: ♀♀, Wahiba, 19.III.1985, M.D. Gallagher. — Yemen: ♀♀ from: Taiz, 26.X.1991; Wadi Surdud, 18.XII.1991; all A. van Harten; 1 ♀, Khazain Yadak, IX.1979, B. Lanza; ♀♀ from: Mafhaq, 9.III.1993; Taiz – Al-Turbah, 14.III.1993; all C.A. Collingwood.

Measurements: SI 0.407; HW/PPW 0.335.

These have the large workers more heavily sculptured than those recorded from Saudi Arabia (COLLINGWOOD 1985). In addition the small workers are also larger and have conspicuous erect pubescence on the antennae and legs. The Saudi Arabian examples are now referred to *P. katonae* above.

Pheidole sinaitica Mayr, 1862

Pheidole sinaitica Mayr, 1862. — Verh. zool.-bot. Ges. Wien 12: 745.

Material: Saudi Arabia: ♀♀ from: Turabah, 26.IX.1980; Rahifa, 7.IX.1984; Harithi, 17.X.1984; Wadi Dhyan, 8.III.1986; all W. Büttiker. — Oman: ♀♀, Jabal Samhan, 1.IX.1989, M.D. Gallagher.

Measurements: SI 0.616; HW/PPW 0.233.

Pheidole teneriffana Forel, 1893

Pheidole teneriffana Forel, 1893. — Ann. Soc. ent. Belg. 37: 465.

Material: Yemen: ♀♀, Al-Kowd, II.1993, A. van Harten.

Winged queens of this widely distributed species were taken at light.

Pheidole sp.

Material: Yemen: 1 ♀, Wadi Wazanan, 14.III.1993, C.A. Collingwood.

A single small worker was taken among leaf litter. It is totally black except for the funiculus which is pale brown. The mesonotal outline is interrupted by a dorsal prominence. The head and alitrunk have strongly punctulate sculpture over the whole dorsum including the nodes. The gaster is smooth and shining. The funiculus segments 2, 3 and 4 are quadrate. Long hairs are scattered over the head, body and appendages. The strong sculpture and dark body colour are unlike those of any other Arabian species collected so far.

Genus *Melissotarsus* Emery, 1877

Melissotarsus emeryi Forel, 1907

Melissotarsus emeryi Forel, 1907. — Revue Ent. 26: 133.

Material: Yemen: ♀♀, Madinat al-Shariq in Wadi Rima, 12.III.1992, A. van Harten; ♀♀ from: Taiz – Mafhaq, 15.II.1993; Bilad Bani, 23.III.1993; all C.A. Collingwood.

This species was found in several low-lying branches of Tamarisk and other trees at Bilad Bani. The ants form tunnels immediately under the bark and do not appear on the surface.

Genus *Leptothorax* Mayr, 1855

Key to species

- | | | |
|---|--------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|
| 1 | Pronotum dentate or angled anterolaterally in dorsal view | 2 |
| — | Pronotum smoothly rounded anterolaterally in dorsal view | 4 |
| 2 | Pronotum strongly dentate; propodeal spines long, robust and down-curved; head and alitrunk dorsum strongly striate to sulcate | <i>Leptothorax humerosus</i> |
| — | Pronotum mildly dentate; propodeal spines short and blunt; body sculpture not strongly developed | 3 |
| 3 | Petiole dorsum flattened, body hairs short, clavate; antennal clubs dark | <i>Leptothorax angulatus</i> |
| — | Petiole dorsum sharply pointed; body hairs bluntly pointed; colour including appendages uniformly brown | <i>Leptothorax saudiae</i> n. sp. |
| 4 | Head and gaster darker than alitrunk; body sculpture strong; antennal scapes short, SI 83-94; propodeal spines acute | 5 |
| — | Unicolorous brown, body sculpture smooth; antennal scapes long, SI 100; propodeal spines broadly dentate | <i>Leptothorax</i> sp. A |
| 5 | Petiole in profile a blunt triangle | <i>Leptothorax</i> sp. B |
| — | Petiole in profile low with a long anterior peduncle | <i>Leptothorax</i> sp. C |

Leptothorax angulatus Mayr, 1862

Leptothorax angulatus Mayr, 1862. — Verh. zool.-bot. Ges. Wien 12: 739.

Material: Saudi Arabia: ♀♀, Wadi Hunayn, 18.IV.1979, Exp. N. Hedjaz (W. Büttiker). — Yemen: ♀♀, Wadi Bani, 23.III.1993, C.A. Collingwood.

This fairly common species has not yet been recorded from Oman. The species was found in Yemen in partially rotten branches.

Leptothorax humerosus Emery, 1846

Leptothorax humerosus Emery, 1846. — Boll. Soc. ent. Ital. 28: 62.

Material: Yemen: 1 ♀, Zingibar, 24.III.1993, C.A. Collingwood.

This species was named on one specimen from an unknown locality in East Africa. There are thus only two examples of this unique, strongly sculptured, dentate species known so far. The Yemen specimen was taken wandering over the ground under shrubs but no other example was found.

Leptothorax saudiae n. sp. (Fig. 9)

Holotype: ♀, Saudi Arabia, Al-Muraywah, 28°46'N 45°00'E, 28.X.1985, W. Büttiker.

Measurements of holotype: TL 2.8; HL 0.81; HW 0.60; SL 0.62; EL 0.17; spine 0.14.

Description: Head subrectangular with rounded occipital corners but straight occipital margin and only very slight curvature of the sides in dorsal view. The pronotum is slightly angled at each corner. The alitrunk has no mesopropodeal furrow and general dorsal outline is rather flat with the propodeum gently curving to its basal face; the propodeal spines are short, blunt and semi-erect. The petiole is thick but raised dorsally to a sharply pointed triangle. The whole dorsum including the gaster has scattered strong hairs which are thick but bluntly pointed rather than clavate. The head dorsum and clypeus are strongly striate. The promesonotum is longitudinally striate, the striae merging into the strongly punctate propodeum. The petiole is brilliant without

sculpture and the postpetiole and gaster dorsum are both shining but with weak superficial sculpture. The body colour is uniformly brown with much paler antennae and legs.

Affinities: This species resembles *L. grisoni* Forel, 1916 in colour and size corresponding with the general body shape of the widely distributed *L. angulatus* but has the following distinctive differences: The body hairs are longer and more pointed, the petiole is sharply angled dorsally as in *L. denticulatus* Mayr, 1901 and the combination of colour, shape and sculpture does not fit any of these three species.

Leptothorax sp. A

Material: Oman: 1 ♀, Jiddat al-Harasis, 16.XII.1984, M.D. Gallagher.

Measurements: TL 3.4; HL 0.73; HW 0.58; SL 0.58; SI 100; spine 0.20.

The pronotal outline is rounded. The mesopropodeal furrow is distinct and breaks the alitrunk outline. The petiole profile is a blunt triangle with the anterior face mildly concave and the dorsal face slightly convex. There are thick blunt hairs over the whole dorsum. The body colour is dark reddish brown and the hairless legs and antennae are yellowish. The head and alitrunk are smooth without distinct sculpture except at the sides. This species resembles *L. cenatus* Bolton, 1982, but has a more angled petiole and the body sculpture is more diffuse.

Leptothorax sp. B

Material: Saudi Arabia: 1 ♀, Hofuf, 20.V.1978, W. Büttiker.

Measurements: TL 3.0; HL 0.77; HW 0.62; SL 0.52; EL 0.17; spine 0.14.

This species is similar to the above but has a shorter antennal scape, sharper propodeal spines and stronger body sculpture. The body colour is dull yellowish with darker head and gaster.

Leptothorax sp. C

Material: Saudi Arabia: 1 ♀, Wadi Durmah, 8.XII.1975, W. Büttiker.

Measurements: TL 3.6; HL 0.89; HW 0.72; SL 0.68; EL 0.17; spine 0.19.

This has similar colour to the above but has closer punctulate sculpture on the head, alitrunk and nodes. The petiole is lower with a long anterior peduncle and the postpetiole is also low. The spines are relatively long and acute.

Genus *Cardiocondyla* Emery, 1869

Key to species

- | | | |
|---|------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|
| 1 | Propodeal spines very short and blunt. | 2 |
| — | Propodeal spines distinct and acute. | 3 |
| 2 | Petiole as broad or broader than long; unicolorous, blackish brown | |
| | | <i>Cardiocondyla shuckardi</i> |
| — | Petiole longer than broad; alitrunk paler than gaster | <i>Cardiocondyla nuda</i> |
| 3 | Petiole in profile with a flattened dorsum | <i>Cardiocondyla emeryi</i> |
| — | Petiole in profile with a rounded dorsum | 4 |
| 4 | Mesonotum descending abruptly to the mesopropodeal groove; gaster darker than pale head and alitrunk; petiole slightly broader than long | |
| | | <i>Cardiocondyla wroughtonii</i> |

- Mesonotum curving evenly to the mesopropodeal groove; gaster unicolorous with head and alitrunk; petiole longer than wide in dorsal view 5
- 5 Postpetiole nearly twice as wide as petiole; colour evenly dark brown
Cardiocondyla gallagheri n. sp.
- Postpetiole narrow, scarcely wider than long and clearly less than twice as wide as petiole; colour of body, legs and antennae evenly pale yellowish brown
Cardiocondyla yemeni n. sp.

Cardiocondyla emeryi Forel, 1881

Cardiocondyla emeryi Forel, 1881. — Mitt. Münch. ent. Ver. 5: 5.

Material: Oman: 1 ♀, Al-Khuwayr, 1.I.1981, W. Büttiker; ♀♀, Mintirib, 17.XI.1984, M.D. Gallagher. — Yemen: ♀♀, Al-Mahwit, 7.VI.1991, A. van Harten.

Cardiocondyla gallagheri n. sp. (Fig. 10)

Holotype: ♀, Oman, Wahiba Sands, 18.XII.1989, M.D. Gallagher. — Paratypes: 4 ♀♀, same series as holotype.

Measurements of holotype: TL 3.23; HL 0.60; HW 0.46; SL 0.47; EL 0.155; PW 0.152; PPW 0.29.

Description: The antennal scapes just fail to meet the occipital margin. The eyes are prominent. The mesopropodeal furrow is shallow, the mesonotum meeting the propodeum at an oblique angle. The propodeum is mildly convex, not flat. The propodeal spines are moderately long (0.09 mm). The petiole is a thick rounded dome longer than wide in dorsal view. The postpetiole is clearly wider than long and almost twice as wide as the petiole. The head is coarsely sculptured with large shallow punctures and a median band of longitudinal striae. The alitrunk and petiole have similar but more superficial sculpture on the dorsum while the postpetiole and gaster are smooth with a faint reticulate sculpture. The colour is evenly brown with legs and antennae only slightly paler.

Affinities: This species differs from *C. emeryi* by the sharper more upright spines, the more shallow mesopropodeal furrow, the more domed petiole, the wider postpetiole and stronger alitrunk sculpture.

Cardiocondyla nuda (Mayr, 1866)

Leptothorax nudus Mayr, 1866. — Verh. zool.-bot. Ges. Wien 16: 508.

Cardiocondyla nuda. — Forel, 1881. — Mitt. Münch. ent. Ver. 5: 6.

Material: Yemen: ♀♀ from: Al-Mahwit, 29.IV.1991; Sana'a, V.1991; Marib, 4.VI.1991; all A. van Harten.

This cosmopolitan species differs from *C. shuckardi* by the coarser sculpture and flatter alitrunk dorsum.

Cardiocondyla shuckardi Forel, 1891

Cardiocondyla shuckardi Forel, 1891. — in Grandidier: Hist. nat. phys. polit. Madag. 20 (2): 161.

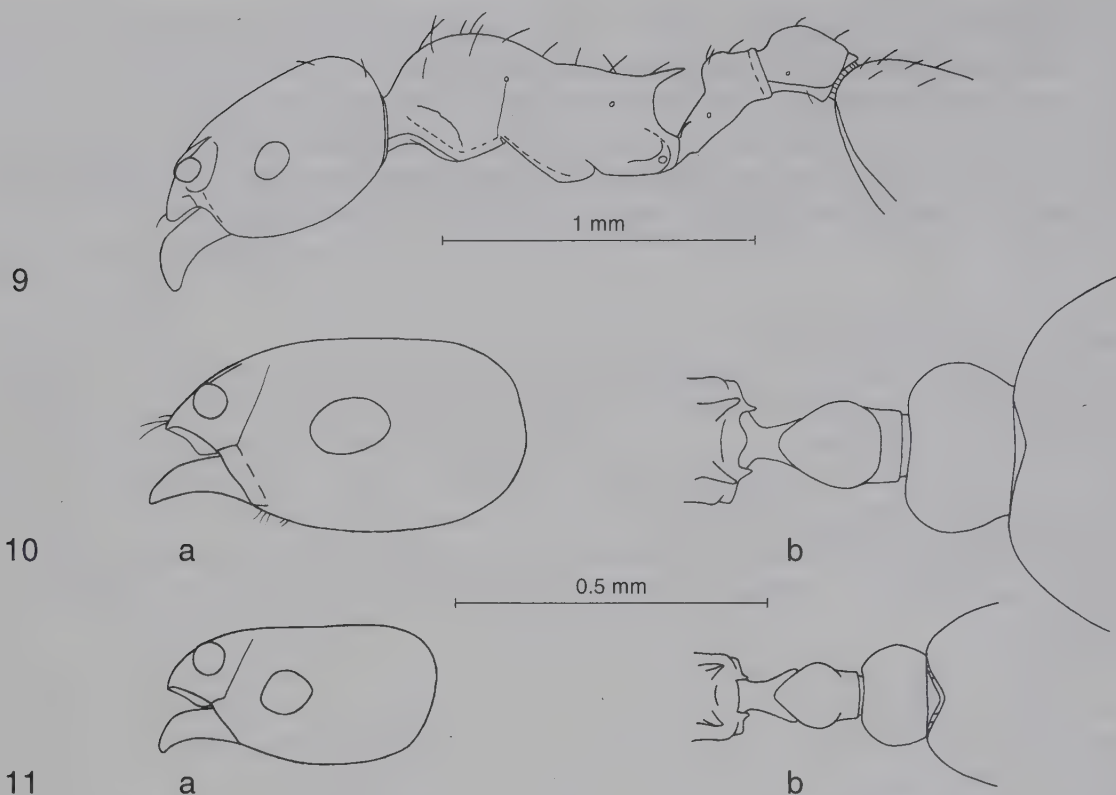
Material: Kuwait: ♀♀, Burgan, 5.IV.1988, W. Büttiker. — Yemen: ♀♀ from: Sana'a, III.1991, IX.1991; Hammam Ali, 5.VIII.1991; Taiz, 20.X.1991; Wadi Surdud, 29.XII.1991; all A. van Harten.

Cardiocondyla wroughtonii (Forel, 1890)

Emeryia wroughtonii Forel, 1890. — Ann. Soc. ent. Belg. 34: 101.

Cardiocondyla wroughtonii. — Forel 1892; Verh. zool.-bot. Ges. Wien 42: 313.

Material: Yemen: ♀♀ from: Al-Mahwit, 29.IV.1991; Sana'a, V.1991; Aden, 18.XII.1991; Wadi Surdud, 29.XII.1991; all A. van Harten.



Figs 9-11: 9, *Leptothorax saudiae* n. sp., ♀, head and alitrunk in profile; 10, *Cardiocondyla gallagheri* n. sp., ♀: a, head in profile; b, petiole and postpetiole in dorsal view; 11, *C. yemeni* n. sp., ♀: a, head in profile; b, petiole and postpetiole in dorsal view.

Cardiocondyla yemeni n. sp. (Fig. 11)

Holotype: ♀, Yemen, Sana'a, 5.III.1993, C.A. Collingwood. — Paratypes: Yemen: 2 ♀♀, same series as holotype; 4 ♀♀, Wadi Surdud, 21.III.1991, A. van Harten.

Measurements of holotype: TL 2.3; HL 0.48; HW 0.38; SL 0.30; EL 0.12; PW 0.11; PPW 0.17.

Description: This species is characterised by its small size, broad dentate spines, reticulopunctate sculpture over the whole dorsum including the gaster and overall pale yellowish-brown colour. In profile the petiole is broadly rounded and relatively low. This is much the smallest of the Arabian species. It is interesting that there were often two or three species of *Cardiocondyla* in the same locality. In particular *C. shuckardi*, *C. wroughtonii* and *C. yemeni* n. sp. were all collected at the same site at Wadi Surdud, and at Sana'a two of these species were seen wandering over the ground in close proximity.

Genus *Crematogaster* Lund, 1831

Key to species

- | | | |
|---|-----------------------------------------------------------------------------------|------------------------------|
| 1 | Postpetiole entire, not bilobed | 2 |
| — | Postpetiole divided dorsally by a median longitudinal furrow into two lobes | 3 |
| 2 | Body colour yellow; propodeal spines long | <i>Crematogaster luctans</i> |
| — | Body colour black; propodeal spines short, dentate | <i>Crematogaster</i> sp. A |

| | | |
|----|------------------------------------------------------------------------------------------------------------------------|-----------------------------------|
| 3 | Gaster in whole or part yellowish or testaceous, lighter than head and alitrunk | 4 |
| — | Gaster uniformly dark, not lighter than head or alitrunk | 5 |
| 4 | Propodeal spines long and acute | <i>Crematogaster flaviventris</i> |
| — | Propodeal armature reduced to minute denticles only visible in complete side view | <i>Crematogaster delagoensis</i> |
| 5 | Bicoloured ants with head and/or alitrunk reddish, lighter than gaster | 6 |
| — | Head, alitrunk and gaster uniformly dark brown or black | 13 |
| 6 | Propodeal spines exceptionally long, at least 0.3 times HW | <i>Crematogaster melanogaster</i> |
| — | Propodeal spines shorter, 0.2 times HW or much less | 7 |
| 7 | Petiole distinctly wider than long | 8 |
| — | Petiole only slightly or not wider than long | 9 |
| 8 | Propodeal spines acute, at least 0.2 mm long; all funiculus segments clearly longer than wide | <i>Crematogaster senegalensis</i> |
| — | Propodeal spines broadly dentate or tuberculate, short; intermediate funiculus segments quadrate | <i>Crematogaster aegyptiaca</i> |
| 9 | Head wider than long | 10 |
| — | Head only slightly or not wider than long | <i>Crematogaster oasisium</i> |
| 10 | Alitrunk paler than head; spines long and acute | <i>Crematogaster chiarinii</i> |
| — | Both head and alitrunk reddish, paler than gaster; spines dentiform or reduced to two tubercles | 11 |
| 11 | Head and alitrunk strongly sculptured; spines broadly dentate | <i>Crematogaster mimosae</i> |
| — | Head and alitrunk weakly sculptured; spines reduced to two tubercles | 12 |
| 12 | Second funiculus segment shorter than third; occiput dull | <i>Crematogaster acaciae</i> |
| — | Second funiculus segment as long as third; occiput shining | <i>Crematogaster antaris</i> |
| 13 | Propodeal spines long and thin | 14 |
| — | Propodeal spines short or broadly dentate | 15 |
| 14 | TL 3.5 or more; postpetiole weakly bilobed; general appearance dull, not shining | <i>Crematogaster affabilis</i> |
| — | Smaller species, TL less than 3.0; postpetiole sharply bilobed, body sculpture superficial, general appearance shining | <i>Crematogaster</i> sp. C |
| 15 | Body sculpture superficial, colour brown, generally brilliant | <i>Crematogaster</i> sp. B |
| — | Body sculpture stronger; colour black to greyish black; general appearance dull | 16 |
| 16 | Mesonotal keel well developed; propodeal spines broadly dentate | <i>Crematogaster laestrygon</i> |
| — | Body sculpture weaker, mesonotal keel very slight; propodeal spines short but acute | 17 |
| 17 | Darker, more robust ants with a distinct mesonotal keel | <i>Crematogaster mosis</i> |
| — | Lighter coloured ants with mesonotal keel indistinct or absent | <i>Crematogaster auberti</i> |

Crematogaster acaciae Forel, 1892

Crematogaster acaciae Forel, 1892. — Zool. Anz. 15: 141.

Material: Oman: 1 ♀, Khadrafi, 4.IV.1981, M.D. Gallagher.

Crematogaster aegyptiaca Mayr, 1862

Crematogaster aegyptiaca Mayr, 1862. — Verh. zool.-bot. Ges. Wien 12: 765.

Material: Saudi Arabia: ♀♀, ♀♀ from: Al-Tawil, 21.XI.1984; Duba, 8.X.1986; all W. Büttiker. — Oman: ♀♀, Marmul, Yalooni, 18.XI.1984, J. Darlington; 1 ♀, Qarn al-Alam, 31.V.1984, M.D. Gallagher. — Yemen: 1 ♀, Wadi Bani, 23.III.1993, C.A. Collingwood.

Measurements: HW 1.22-1.26; CI 108-118; PL/PW 0.58-0.63.

Crematogaster affabilis Forel, 1907

Crematogaster chiarinii var. *affabilis* Forel, 1907. — Revue Ent. 26: 142.

Material: Saudi Arabia: ♀♀, ♀♀ from: El Shoiba, 25.XII.1984; Wadi Damad, 24.IX.1986; Wadi Wajj, 9.X.1973; all W. Büttiker. — Oman: ♀♀ from: Wadi Armalet, 17.II.1984; Al-Khawr, 17.IX.1984; all M.D. Gallagher; ♀♀, Tar Ab salt marsh, 21.X.1985, J. Darlington. — Yemen: ♀♀ from: Suq Bani Mansur, 27.IV.1991; Taiz, 20.X.1991; Wadi Surdud, 29.XI.1991; Sana'a, 5.IX.1991; all A. van Harten; ♀♀, Makalla Seyun, 24.III.1992, M. Mahyoub.

This arboreal, long-spined, black species is common in southern Arabia wherever there are trees.

Crematogaster antaris Forel, 1894

Crematogaster auberti antaris Forel, 1894. — Bull. Soc. Vaud. Sci. nat. 30: 26.

Material: Kuwait: ♀♀, Jabal Dhablan, 3.V.1988, W. Büttiker. — United Arab Emirates: ♀♀, Ras Ghanada, XI.1992, B. Tigar. — Oman: ♀♀, ♀♀ from: Qarn Huwayda, 7.I.1982; Jiddat al-Harasis, 16.XII.1984; Wadi Sayq, 21.XII.1982; Wadi Bartha, 19.XI.1985; Barr al-Hickman, 4.XII.1987; all M.D. Gallagher. — Yemen: ♀♀, Mocha Gocha, 23.III.1992, A. van Harten.

Measurements: HW 1.08-1.45; CI 104-114; PL/PW 0.68-0.715.

Crematogaster aegyptiaca is sometimes as red as the deserticolous *C. antaris* but is usually darker, more rugose and pubescent; the petiole is wider with the anterolateral corners produced and wing-like in full dorsal view. Queens of *C. antaris* are larger, have the head and alitrunk red and have characteristic lateral striae on the occiput.

Crematogaster auberti Emery, 1869

Crematogaster auberti Emery, 1869. — Annali Acad. Aspir. nat. Napoli 2: 23.

Crematogaster oasisum. — Santschi 1937; Mem. Soc. Vaud. Sci. nat. 5: 303.

Material: Saudi Arabia: ♀♀, Taif, 2100 m, 20.IV.1976, W. Büttiker.

Crematogaster chiarinii Emery, 1881

Crematogaster chiarinii Emery, 1881. — Ann. Mus. civ. Stor. nat. Genova 16: 271.

Crematogaster affabilis. — Collingwood 1985; Fauna of Saudi Arabia 7: 260.

Material: Saudi Arabia: 1 ♀, ♀♀, Wadi Hanifa, 28.IX.1978, W. Büttiker.

Crematogaster delagoensis Forel, 1894

Crematogaster inermis st. *delagoensis* Forel, 1894. — Mitt. Schweiz. ent. Ges. 57: 126.

Crematogaster delagoensis. — Emery 1921; Gen. Ins. 174: 146.

Material: Oman: ♀♀ from: Ain Umrn, 10.IX.1984; Qusabiet, 29.IV.1984; all M.D. Gallagher. — Yemen: ♀♀, Taiz, 20.X.1991, A. van Harten.

Measurements: HW 0.63; SI 104.

This species is like *C. flaviventris* in general appearance but has smoother sculpture, is much smaller and the propodeal armature is reduced to minute denticles. It is similar to *C. inermis* Mayr, 1862 of Egypt and Palestine apart from the paler gaster and angulate propodeum.

Crematogaster flaviventris Santschi, 1910

Crematogaster flaviventris Santschi, 1910. — Ann. Soc. ent. Fr. 78: 370.

Material: Yemen: ♀♀ from: Hammam Ali, 5.VIII.1991; Sadah, 13.VIII.1991; Zabid, 26.VIII.1991; Rissabah, 8.X.1991; all A. van Harten.

Measurements: HW 1.21; SI 85.

This is a member of the *C. castanea* Smith, 1858 complex distinguished by the yellowish gaster contrasting with the brown head and alitrunk. The propodeal spines are sharp and well developed with a downward curvature.

***Crematogaster laestrygon* Emery, 1869**

Crematogaster laestrygon Emery, 1869. — Boll. Soc. ent. Ital. 1: 135.

Material: Yemen: ♀♀ from: Sana'a, III.1991; Kewkaban, 24.IX.1991; Rissabah, 8.X.1991; Djebel an-Nabi Shuaib, 29.IX.1991; all A. van Harten.

This highland species varies in colour from totally dark to various shades of grey sometimes with a reddish tinge but can always be recognised by the strongly developed mesonotal keel and the very short dentate propodeal spines. This species was the only ant found right at the top of Arabia's highest mountain, Djebel an-Nabi Shuaib, at 3750 m.

***Crematogaster melanogaster* Emery, 1895; n. stat.**

Crematogaster arborea melanogaster Emery, 1895. — Ann. Soc. ent. Fr. 64: 29.

Material: Oman: ♀♀, Jabal Qara, 21.X.1984, J. Darlington; ♀♀ from: Rakyat Plateau, 21.IX.1984; Wadi Bani Kharus, 13.X.1984; all M.D. Gallagher.

This species was keyed but not named or described in COLLINGWOOD (1985). It is characterised by the exceptionally long straight propodeal spines which are more than one third the head width and the colour contrast between the yellowish-red head and alitrunk and the dark gaster. It was described and recorded from various localities in South Africa.

***Crematogaster mimosae* Santschi, 1914**

Crematogaster mimosae Santschi, 1914. — Voy. Alluad & Jeannel Afr. d'or. Hym: 87.

Material: Saudi Arabia: ♀♀ from: Wadi Harth, 28.IX.1978; Jebel an-Nir, 2.X.1984; Wadi Hanaq, 15.X.1985; all W. Büttiker. — Oman: ♀♀, Qarn Nature Reserve, 4.II.1987, M.D. Gallagher. — Yemen: ♀♀, Al-Mahwit, 21.IX.1991, A. van Harten; 1 ♀, Shaher beach, 20.II.1992, M. Mahyoub.

***Crematogaster mosis* Emery, 1869**

Crematogaster mosis Emery, 1869. — Boll. Soc. ent. Ital. 1: 35.

Material: United Arab Emirates: ♀♀, Baynunah, X.1993, B. Tigar. — Yemen: ♀♀, Al-Mahwit, III.1993, C.A. Collingwood.

***Crematogaster oasisium* Santschi, 1911**

Crematogaster auberti st. *oasisium* Santschi, 1911. — Bull. Hist. nat. Afr. nd. 3: 84.

Material: Saudi Arabia: ♀♀ from: Wadi Harth, 21.IX.1978; Jabal Dhablan, 3.X.1985; all W. Büttiker. — Oman: ♀♀ from: Marmul, 4.I.1979; Baushar, 29.IV.1982; all M.D. Gallagher.

***Crematogaster senegalensis* Roger, 1863**

Crematogaster senegalensis Roger, 1863. — Berl. ent. Z. 7: 206.

Material: Saudi Arabia: ♀♀ from: Jeddah, 27.XII.1978; Al-Hibri, III.1985; all W. Büttiker. — Oman: ♀♀ from: Wadi Dibab, 4.IV.1985; Jabal Shams, 26.X.1986; all M.D. Gallagher. — Yemen: ♀♀, Wadi Surdud, 29.XI.1991, A. van Harten.

There are a number of additional species that could not be named from existing literature or museum collections and these are briefly described below.

Crematogaster sp. A

Material: Yemen: 1 ♀, Mabab, pitfall trap, V.1992, M. Mahyoub.

This is a small black ant very like *C. striatula* Emery, 1892 of tropical Africa in size and general appearance. The dorsum of the rounded postpetiole, however, is coarsely striate and not smooth as in *C. striatula*.

Crematogaster sp. B

Material: United Arab Emirates: 1 ♀, Baynunah, X.1993, B. Tigar. — Oman: 1 ♀, Ras Dhabdhub, 31°32'N 58°49'E, M.D. Gallagher.

Measurements: TL 3.40; HL 0.87; HW 0.89; EL 0.25; spine 0.08.

This is a glossy brown species with weak superficial sculpture especially on the head which is brilliant. The pronotal corners are distinctly angled. The propodeal spines are short but strong. The eyes are relatively large and prominent set behind the midline of the head which is broader than long. There are short curved hairs on the genae below the eyes. This species differs from *C. acaciae* by the strong spines and from *C. chiarinii* by smooth sculpture and brilliant appearance.

Crematogaster sp. C

Material: Yemen: ♀♀, Zingibar, 23.III.1993, C.A. Collingwood.

Measurements: TL 3.25-3.40; HL 0.82-0.86; HW 0.85-0.86; SL 0.66; EL 0.21.

This is a small black species with long propodeal spines as in *C. affabilis*. The funiculus segments are slightly longer than broad. The promesonotum is flat, not keeled. The mesonotum meets the propodeum at an acute angle. The petiole is slightly longer than broad. The postpetiole is deeply bilobed and has the posterodorsal face projected backward over the first gaster tergite. This species differs from *C. affabilis* in its smaller size, more deeply bilobed postpetiole and slightly stronger body sculpture. It was seen ascending shrubby trees by the wayside near Zingibar.

Crematogaster sp. D

Material: Yemen: 5 ♀♀ from: Wadi al-Burakani, II.1992, M. Mahyoub; Valley below Sumara Pass, 13.III.1993; all C.A. Collingwood.

This is another long-spined, dark species. The funiculus segments are all longer than wide; the petiole is distinctly wider than long, unlike the last species, and it also differs from that species as well as *C. affabilis* by the much more sculptured punctulate head and alitrunk. The dorsum of the postpetiole and the gaster have long decumbent pubescence.

Genus *Tetramorium* Mayr, 1855

There are three additional species in this genus and one name change as well as a few new records of some interest.

Key to species

- | | | |
|---|--------------------------------------------------------------------------------------------------------------|--------------------------------|
| 1 | Alitrunk uninterrupted by dorsal sutures; body hairs long and profuse | <i>Tetramorium lanuginosum</i> |
| — | Alitrunk with a mesopropodeal suture, impressed in most species; pilosity variable but not profuse | 2 |

- 2 Petiole and postpetiole clearly wider than long *Tetramorium latinode* n. sp. 3
 – At least petiole not distinctly wider than long 3
 3 Tibiae with stout suberect hairs. 4
 – Tibiae without suberect hairs on extensor surface 9
 4 Petiole and postpetiole with distinct dorsal sculpture 5
 – Petiole and postpetiole smooth and shining 6
 5 Nodes coarsely sulcate; colour dark brown or greyish brown
Tetramorium turcomanicum
 – Nodes irregularly sculptured; colour pale yellowish or reddish brown
Tetramorium syriacum
 6 Head and alitrunk strongly sculptured 7
 – Head and alitrunk sculpture superficial, smooth in part 8
 7 Colour black; propodeal spines very short, upturned; striae on occiput divergent
Tetramorium biskrense
 – Colour pale reddish yellow; head striae longitudinal to the occipital border
Tetramorium calidum
 8 Dorsum of head with distinct median depressed area; propodeal spines short but acute; alitrunk moderately sculptured *Tetramorium depressiceps*
 – Dorsum of head without a median depression; propodeal armature bluntly tuberculate not dentate; alitrunk smooth and shining *Tetramorium juba*
 9 Larger species, HW 0.70 or more; petiole in dorsal view longer than broad 10
 – Smaller species, HW 0.56 or less; petiole broader than long 12
 10 Propodeal spines minute, sometimes absent *Tetramorium doriae*
 – Propodeal spines strongly developed 11
 11 Propodeal dorsum with one or two pairs of suberect hairs *Tetramorium khyarum*
 – Propodeal dorsum without hairs *Tetramorium sericeiventre*
 12 Longitudinal rugae on head weakly developed *Tetramorium caldarium*
 – Longitudinal rugae on head strongly developed 13
 13 Genae without projecting hairs *Tetramorium simillimum*
 – Genae with one or more projecting hairs at each side 14
 14 Genae with one or two projecting hairs above and below eyes at each side
Tetramorium jizani
 – Genae with one or two projecting hairs above the eyes at each side
Tetramorium delagoense
 – Genae between occiput and eye with one projecting hair below the eye at each side
Tetramorium yemene n. sp.

Tetramorium biskrense Forel, 1904

Tetramorium caespitum var. *biskrensis* Forel, 1904. — Rev. Suisse Zool. 12: 13.

Tetramorium biskrense. — Menozzi 1933; Mem. Soc. ent. Ital. 12: 75.

Material: Saudi Arabia: ♀♀, Abha, 10.IV.1972. — Oman: 1 ♀, ♀♀, Wadi Sayq, 22.III.1986, W. Büttiker. — Kuwait: 1 ♂, 1 ♀, 1 ♀, Al-Rileg al-Shamali, 26.III.1988, W. Büttiker.

The queen of this species, HW 1.2, SL 0.7, has an angled pronotum fully visible in dorsal view and wide nodes with a narrow sharp crest seen in side view. The propodeum is dentate. The head is striate with the striae curving obliquely at the occiput. The mesonotum is confusedly sculptured with the centre dorsum brilliant and strong sculpture at the sides. The gaster is brilliant with a few widely spaced punctures. The male is pale with weak sculpture.

Tetramorium caldarium* (Roger, 1857)Tetrogmus caldarius* Roger, 1857. — Berl. ent. Z. 1: 12.*Tetramorium caldarium*. — Roger, 1862; Berl. ent. Z. 6: 297.

Material: Oman: 1 ♀, Al-Uqdah, 1.IV.1984, W. Büttiker. — Yemen: ♀♀ from: Bajd Zabid, 15.III.1993; Wadi Bani, 20.III.1993; all C.A. Collingwood.

Tetramorium calidum* Forel, 1907Tetramorium caespitum* var. *calida* Forel, 1907. — Ann. hist.-nat. Mus. natn. Hung. 5: 15.*Tetramorium calidum*. — Collingwood 1985; Fauna of Saudi Arabia 7: 263.

Material: Oman: ♀♀ from: Jiddat Sahara, 28.XI.1986; Khasab Musandham, 18.XI.1986; all R. Braund. — Yemen: 1 ♀, Al-Mahwit, 20.IV.1991, A. van Harten.

Tetramorium delagoense* Forel, 1894Tetramorium simillimum* st. *delagoensis* Forel, 1894. — Mitt. Schweiz. ent. Ges. 9: 80.*Tetramorium delagoense*. — Bolton 1979; Bull. Br. Mus. nat. Hist. Ent. 38: 156.

Material: Yemen: ♀♀ from: Hajjah, 12.III.1991; Sadah, 13.VIII.1991; all A. van Harten.

This species is much like *T. simillimum* with very similar size, form and sculpture. It differs in having one or two projecting hairs on the genae at each side between the occiput and eye level. It is recorded from a wide area in Saharan and sub-Saharan Africa (BOLTON 1980) and also recently in Palestine.

Tetramorium depressiceps* Menozzi, 1933Tetramorium semilaeve depressiceps* Menozzi, 1933. — Mem. Soc. ent. Ital. 12: 71.*Tetramorium depressiceps*. — Collingwood 1985; Fauna of Saudi Arabia 7: 264.

Material: Saudi Arabia: ♀♀ from: Wadi Tumair, 7.II.1976; Wadi Azizah, 18.IX.1983; Harithi, 5.X.1984; all W. Büttiker. — Oman: ♀♀, Wadi Harth, 13.II.1986, J.E. Clarke.

Tetramorium doriae* Emery, 1881Tetramorium doriae* Emery, 1881. — Ann. Mus. civ. Stor. nat. Giacomo Doria 16: 530.

Material: Saudi Arabia: 3 ♀♀, Wadi Hanaq, 31.I.1985, W. Büttiker.

Both *T. calidum* and *T. doriae* were described from Arabia but both species are little known and seem to be quite uncommon compared with some other members of the genus.

Tetramorium jizani* Collingwood, 1985Tetramorium jizani* Collingwood, 1985. — Fauna of Saudi Arabia 7: 263.

Material: Yemen: ♀♀, Sana'a, 4.XII.1991, A. van Harten.

This species, described from Saudi Arabia not far from the Yemen border, seems to replace the widely distributed *T. simillimum* in that area.

Tetramorium juba* Collingwood, 1985Tetramorium juba*, Collingwood, 1985. — Fauna of Saudi Arabia 7: 264.

Material: Saudi Arabia: ♀♀, ♀♀ from: Qarah Village, 16.IV.1976; Wadi Mizbil, 25.II.1977; all W. Büttiker. — Kuwait: 1 ♀, Jal al-Zour, 6.II.1988, W. Büttiker.

Tetramorium khyarum* Bolton, 1980Tetramorium khyarum* Bolton, 1980. — Bull. Br. Mus. nat. Hist. 40 (3): 327.

Material: Yemen: ♀♀, Al-Mahwit, 20.IV.1991, A. van Harten.

Tetramorium lanuginosum Mayr, 1870

Tetramorium lanuginosum Mayr, 1870. — Verh. zool.-bot. Ges. Wien 20: 972.

Triglyphothrix lanuginosa. — Collingwood 1985; Fauna of Saudi Arabia 7: 258. [Generic synonymy by BOLTON 1985: 247].

Tetramorium latinode n. sp. (Fig. 12)

Holotype: 1 ♀, Yemen, Mabar, pitfall trap, 11.V.1992, M. Mahyoub & A. Drews.

Measurements of holotype: TL 2.34; HL 0.80; HW 0.64; SL 0.56; PW 0.30; PPW 0.37.

Description: This species is similar to *T. squaminode* Santschi, 1910, with both petiole and postpetiole being much wider than long in dorsal view but the petiole crest is thicker and has rounded sides compared with that species. The propodeal spines are long and strong. The mandibles are finely striate. The head and clypeus are strongly striate; the alitrunk has coarse irregular reticulate sculpture with three striae between the spines. All body surfaces have long clubbed hairs and the scapes and legs have crowded, shorter, suberect hairs.

Tetramorium sericeiventris Emery, 1877

Tetramorium sericeiventris Emery, 1877. — Ann. Mus. civ. Stor. nat. Giacomo Doria 9: 370.

Material: Saudi Arabia: ♀♀ from: Taif, 20.V.1976; Wadi Khumra, 14.X.1976; Wadi Shoib Luha, 3.IX.1976; all W. Büttiker. — Oman: 1 ♂, ♀♀, ♀♀ from: Jabal Qara, 16.IX.1982; Hawayah, 18.VII.1984; Yalooni, 3.X.1984; Khawr Sawli, 13.I.1985; Jabal Samhan, 20.IV.1986; Umm Qashrab, 2.VIII.1986; all M.D. Gallagher. — Yemen: ♀♀ from: Sana'a, V.1991; Al-Butanah, 12.VIII.1991; all A. van Harten; ♂♂, ♀♀, ♀♀ from: Wadi Bani, 20.III.1993; Zingibar, 20.III.1993; all C.A. Collingwood.

This is the most conspicuous species of the genus in southern Arabia. Males were found in numbers at a garage site near Zingibar on 20.III.1993.

Tetramorium syriacum Emery, 1909

Tetramorium caespitum var. *syriaca* Emery, 1909. — Dt. ent. Z. (1909): 699.

Tetramorium syriacum. — Collingwood 1985; Fauna of Saudi Arabia 7: 265.

Material: Saudi Arabia: ♀♀, ♀♀ from: Wadi Tumair, 27.II.1976; Wadi Khumra, 18.III.1976; Wadi Marba, 7.IV.1976; Wadi Shuqub, 26.IV.1984; all W. Büttiker.

Tetramorium turcomanicum Santschi, 1921

Tetramorium caespitum st. *turcomanicum* Santschi, 1921. — Bol. R. Soc. esp. Hist. nat. 21: 111.

Tetramorium turcomanicum. — Tarbinsky 1976; Murav'i Kirgizii: 109.

Material: Saudi Arabia: ♀♀ from: Uyaynah, I.IV.1976; Wadi Khumra, 8.II.1976; Kashm al-Buwaybiyat, V.1978; all W. Büttiker; ♀♀ (recorded as *T. ferox*), Riyadh, 23.III.1983, C.A. Collingwood. — Oman: ♀♀, Jabal Khartam, 22.IV.1986, W. Büttiker. — Yemen: ♀♀ from: Marib, 4.VI.1991; Sana'a, VIII.1991; all A. van Harten.

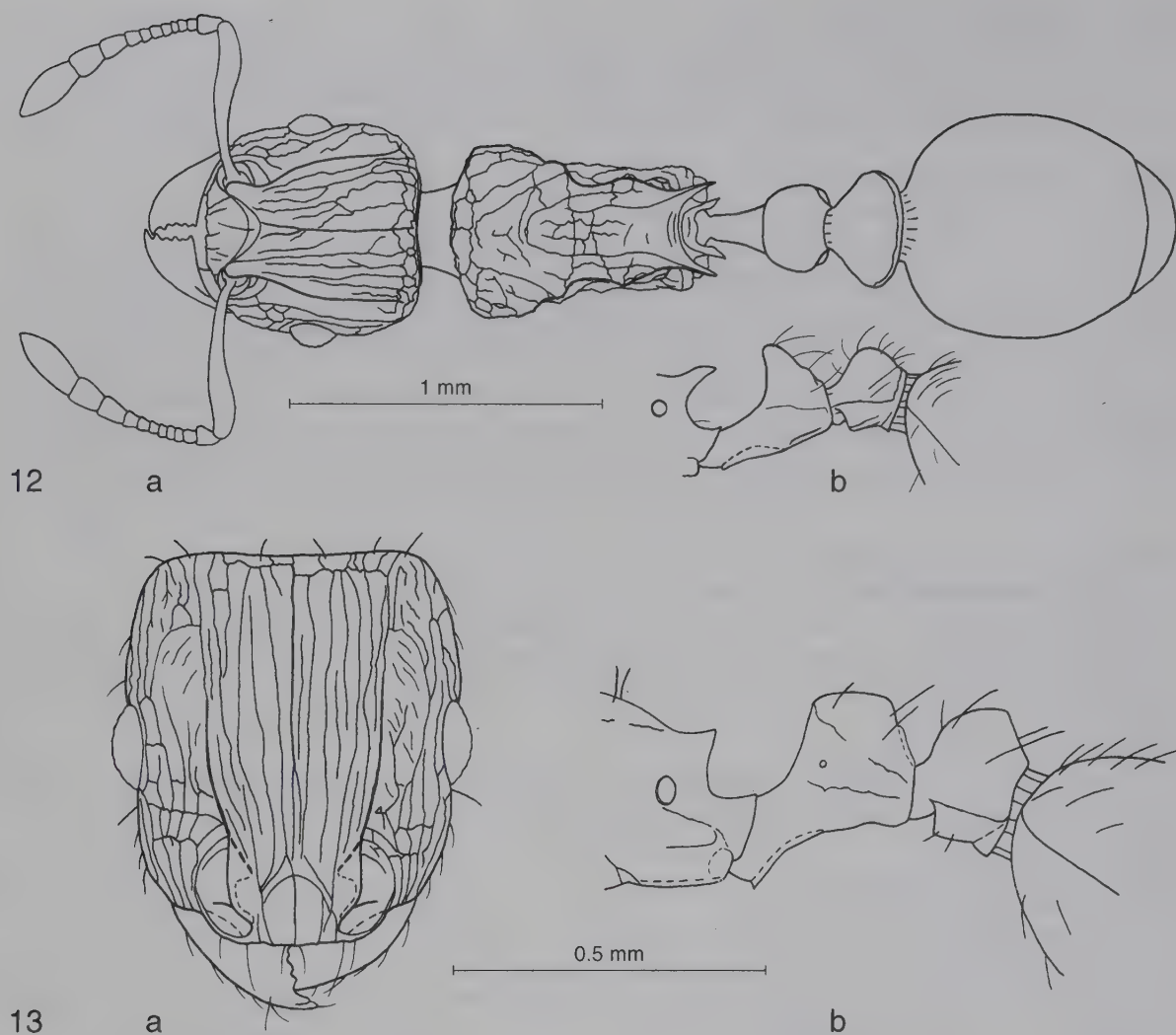
This species was wrongly referred to *T. ferox* Ruzsky, 1903 in COLLINGWOOD (1985). The colour varies from mid to dark brown; the nodes are sculptured but the propodeal spines are shorter than in *T. ferox* or the rather similar *T. chefteki* Forel, 1911 in Greece and Turkey.

Tetramorium yemene n. sp. (Fig. 13)

Holotype: ♀, Yemen, Sid el Feyhn, 10.VI.1992, A. van Harten. — Paratypes: ♂♂, 1 ♀, 1 ♀, same series as holotype.

Measurements of holotype: TL 2.6; HL 0.67; HW 0.58; SL 0.43; EL/HW 0.232; CI 86.5.

Description: This species, like *T. jizani*, resembles *T. simillimum* having distinct frontal carinae extending back almost to the occiput. The head and alitrunk have strong longitudinal striae with intermediate reticulate sculpture which is more weakly developed on the propodeum.



Figs 12-13: 12, *Tetramorium latinode* n. sp., ♀: a, dorsal view; b, nodes in profile; 13, *T. yemene* n. sp., ♀: a, head in dorsal view; b, propodeum and nodes in profile.

The nodes have punctulate sculpture only. The head and alitrunk dorsum have short blunt hairs and there is one long oblique hair at each side of the head below the eye. The petiole has two pairs and the postpetiole three pairs of hairs. The head and alitrunk are brown and the gaster is dark, the legs and antennae yellowish.

The queen, TL 3.60, has similar colour, sculpture and pilosity to the worker but the gaster hairs are more numerous. The propodeal spines are well developed.

The male, TL 2.80, has a large expanded mesonotum, shining without sculpture except at the sides; the scutellum and propodeum are longitudinally striate. The head has moderately dense punctulate sculpture which becomes transverse on the occiput behind the eyes. There is one oblique hair at each side of the head below the eyes as in the female castes.

Affinities: This species differs from *T. jizani* by the much fewer head hairs and more widely spaced head sculpture and from *T. simillimum* by the single hair below the eyes and the reduced petiole sculpture.

Tetramorium zahrae Santschi, 1923*Tetramorium zahrae* Santschi, 1923. — Bol. R. Soc. esp. Hist. nat. 23: 135.

Material: Yemen: 1 ♀, Sinhan, 30.VIII.1991, A. van Harten.

Measurements: HL 1.38; HW 1.28; SI 67; PPW 0.63.

Colour entirely black. Pronotal shoulders visible from above but rounded, not angulate. Head and mesonotum longitudinally striate, gaster brilliant. Propodeum bituberculate, not dentate. Postpetiole wider than long with rounded sides.

Genus *Monomorium* Mayr, 1855

Over 50 species of this genus have now been recognised from the Arabian Peninsula. It should be said that without the revision of sub-Saharan species by BOLTON (1987), it would have been scarcely possible to sort out the Arabian species in any sensible fashion. Two very important characters that were overlooked in COLLINGWOOD (1985) but brought out in the comprehensive review by BOLTON (1987) are the presence, disposition or absence of hairs on the alitrunk dorsum and relative eye size. Examination of these features has shown several species that were not recognised in the previous paper and has also necessitated some name changes. The Arabian *Monomorium* fauna is clearly a very rich fauna which merits continuing investigation especially as some of the more interesting species are only represented by one or two specimens. An interesting feature is the large eye size in a large number of Arabian species, possibly an adaptation to nocturnal foraging through the necessary avoidance of extreme daytime temperatures during the summer months.

Key to species

- | | | |
|---|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------|
| 1 | Terminal funiculus segment longer than the two preceding segments together | 2 |
| — | Terminal funiculus segment shorter than the two preceding segments together | 9 |
| 2 | Antennae with 11 segments | 3 |
| — | Antennae with 12 segments | 5 |
| 3 | Alitrunk entirely without dorsal hairs | <i>Monomorium aeyade</i> n. sp. |
| — | Alitrunk with suberect dorsal hairs | 4 |
| 4 | Terminal funiculus segment broadly swollen | <i>Monomorium clavicorne</i> |
| — | Terminal funiculus segment enlarged but not conspicuously swollen | <i>Monomorium baushare</i> n. sp. |
| 5 | Body colour uniformly dark | 6 |
| — | Body colour yellow or bicoloured | 7 |
| 6 | Mandibles smooth with scattered hair pits; colour bright chocolate brown; antennal scape exceptionally long, SI 115 | <i>Monomorium brunneolucidulum</i> n. sp. |
| — | Mandibles striated; colour evenly blackish brown; antennal scapes shorter, SI less than 80 | <i>Monomorium carbonarium</i> |
| 7 | Colour uniformly yellow. | 8 |
| — | Bicoloured, alitrunk yellow contrasting with glossy black gaster | <i>Monomorium rimae</i> n. sp. |
| 8 | Head with long hairs surrounding occiput and genae in dorsal view; propodeal dorsum rounds gently into the basal face; petiole a broadly rounded triangle in profile | <i>Monomorium qarabe</i> n. sp. |

| | | | |
|----|------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------|----|
| – | Head without a fringe of long hairs; propodeal dorsum rounds steeply into the basal face; petiole a high rounded cone | <i>Monomorium montanum</i> n. sp. | |
| 9 | Antennal scapes short, clearly not reaching occiput, SI less than 80 | | 10 |
| – | Antennal scapes reaching or surpassing occiput, SI 91-115 | | 15 |
| 10 | Propodeal spiracle slit-like. Terminal funiculus segments thin, not forming a distinct club | <i>Monomorium dentigerum</i> | |
| – | Propodeal spiracle circular. Terminal funiculus segments form a distinct three-segmented club | | 11 |
| 11 | Underside of head with crowded J-shaped hairs forming a distinct psammophore; workers in the same colony of more or less even size | | 12 |
| – | Underside of head with few scattered hairs not forming a distinct psammophore; polymorphic, with workers of different sizes in the same colony | | 13 |
| 12 | Body colour yellowish brown; eye size moderate, 0.22-0.25 times HW | | |
| | | <i>Monomorium chobauti</i> | |
| – | Colour black; eyes exceptionally large, 0.34 times HW | <i>Monomorium barbatulum</i> | |
| 13 | Colour greyish to black | | 14 |
| – | Head and alitrunk yellowish | <i>Monomorium destructor</i> | |
| 14 | Occiput as well as propodeum with fine transverse striae | <i>Monomorium mayri</i> | |
| – | Occiput with confused sculpture, not striate | <i>Monomorium robustior</i> | |
| 15 | Dorsum of alitrunk without projecting hairs | | 16 |
| – | Dorsum of alitrunk with projecting hairs | | 32 |
| 16 | Head and alitrunk clear red, contrasting with dark gaster | | 17 |
| – | Head darker than alitrunk or whole body unicolorous brown to black | | 20 |
| 17 | Eyes large, 0.3 times HW or more | <i>Monomorium venustum</i> | |
| – | Eyes small, 0.25 times HW or less | | 18 |
| 18 | Propodeal dorsum with distinct longitudinal furrow | | 19 |
| – | Propodeal dorsum with slight shallow incavation at most | <i>Monomorium bicolor</i> | |
| 19 | Propodeal dorsum raised and angled posteriorly to form two blunt slightly projecting bosses; head broad, CI over 85 | <i>Monomorium subdenticorne</i> n. sp. | |
| – | Propodeum low with rounded posterior face; head narrow, CI less than 75 | | |
| | | <i>Monomorium nitidiventre</i> | |
| 20 | Propodeum with a distinct longitudinal furrow | | 21 |
| – | Propodeal outline smooth without a longitudinal furrow | | 22 |
| 21 | Body generally shining; dorsum rather flat; size smaller, HW 0.48-0.51 | | |
| | | <i>Monomorium haritche</i> n. sp. | |
| – | Body more sculptured, dull; more robust; size larger. HW 0.60-0.65 | | |
| | | <i>Monomorium phoenicium</i> | |
| 22 | Eyes smaller, 0.25 times HW or less | | 23 |
| – | Eyes larger, 0.30 times HW or more | | 26 |
| 23 | Body colour entirely black | <i>Monomorium carbo</i> | |
| – | Body colour otherwise | | 24 |
| 24 | Body colour dull greyish yellow | <i>Monomorium majarishe</i> n. sp. | |
| – | Body colour reddish brown to brown | | 25 |
| 25 | Head and gaster moderately shining; mesopropodeal furrow distinct, making a right angle in profile | <i>Monomorium salomonis</i> | |
| – | Head more sculptured; dorsum of alitrunk flatter with mesonotum meeting propodeum at an oblique angle | <i>Monomorium subopacum</i> | |

- 26 TL less than 2.5; densely sculptured including gaster; uniformly black
Monomorium najrane n. sp.
- Larger ants, TL more than 3.8; gaster moderately shining; alitrunk often lighter than gaster 27
- 27 Petiole nodes wider than long, about 0.3 times HW; head and alitrunk moderately shining
Monomorium marmule n. sp.
- Petiole nodes narrower, about 0.25 times HW; head and alitrunk with distinct reticulopunctate sculpture 28
- 28 Dorsum of head, nodes and gaster darker than alitrunk
Monomorium fezzanense n. sp.
- Head and nodes concolorous pale brown with alitrunk 29
- 29 Petiole a high triangle in side view, narrow in dorsal view
Monomorium acutinode n. sp.
- Petiole broadly rounded, slightly wider than long in side view 30
- 30 Gaster tergite 1 with a double row of erect hairs; gaster darker than alitrunk
Monomorium hemame n. sp.
- Gaster tergite 1 without erect hairs anterior to the apical row; gaster not distinctly darker than alitrunk 31
- 31 Ventral head always with a few projecting hairs
Monomorium areniphilum
- Ventral head entirely without hairs posterior to the maxillae
Monomorium dirie n. sp.
- 32 Larger species, TL at least 3.8; HW more than 0.75 33
- Smaller species, TL 2.2-3.2; HW 0.64 or less 36
- 33 Whole body yellowish; alitrunk rather flat with a shallow oblique mesopropodeal furrow
Monomorium luteum
- Gaster dark contrasting with red alitrunk; mesonotum and propodeum meeting at a steep angle 34
- 34 Head, alitrunk nodes and appendages red 35
- Head and antennal clubs clearly darker than red alitrunk
Monomorium matame n. sp.
- 35 Head smooth with superficial sculpture
Monomorium niloticum
- Head completely finely striate
Monomorium riyahe n. sp.
- 36 Alitrunk red, contrasting with dark gaster 37
- Alitrunk pale brown to black, concolorous with gaster 41
- 37 Whole of dorsum clothed with fine pale hairs; antennae clothed with crowded erect pubescence
Monomorium yemene n. sp.
- Dorsum of alitrunk with few hairs; scape pubescence short, subdecumbent 38
- 38 Alitrunk with several pairs of hairs scattered over whole dorsum 39
- Alitrunk hairs restricted to one pair on the pronotum 40
- 39 Eyes very small, 0.2 times HW; scapes long, SI 110-112; gaster shining black
Monomorium knappi n. sp.
- Eyes larger, 0.23-0.25 times HW; scapes shorter, SI 89-102; gaster dull black
Monomorium fayfaense n. sp.
- 40 Head and alitrunk dull red, gaster brown; laid back scapes reach the occipital border
Monomorium hanage n. sp.
- Head and alitrunk bright orange red, gaster black; laid back scapes fail to reach the occipital border
Monomorium jizane n. sp.

dorsal view with rounded corners. In profile the alitrunk has the promesonotal dorsum meeting the flat propodeum at an oblique angle. The propodeum has a characteristic well-defined, longitudinal V-shaped furrow bordered by a distinct raised edge at each side. The petiole in profile is a high rounded triangle, in dorsal view mildly transverse but not wider than the postpetiole. The pronotum has one pair of hairs, the petiole one pair and the postpetiole two pairs. There are a few scattered hairs on the first gastral tergite. The head, pronotum and nodes have superficial reticulate sculpture; the mesopropodeum and the sides of the head are coarsely punctate. The gaster is brilliant with very superficial sculpture. The body colour is evenly brownish black to black with reddish articulations, pale funiculi, tarsi and mandibles. This is a wide-ranging Middle Eastern species found throughout Arabia from coastal lowland to high mountains.

Monomorium acutinode n. sp. (Fig. 14)

Holotype: ♀, Oman, Qarn al-Alam, 31.V.1989, M.D. Gallagher. — Paratypes: 1 ♀, 1 ♀, same series as holotype.

Measurements of holotype: HL 0.91; HW 0.76; SL 0.82; EL 0.25; CI 83.8; SI 107.

Description: The head of this species is more rectangular than in the other members of this group. The petiole is a high cone in profile 0.28-0.29 mm and narrow in dorsal view, 0.21 mm. The head and alitrunk are less sculptured than in *M. areniphilum* but the main difference is the high, relatively narrow petiole. The queen has a high, sharply angled petiole which, unlike in the other species, is almost smooth with very faint sculpture and the dorsum is emarginate. The *M. areniphilum* queen also has a high node but it is much more sculptured with a smoothly rounded crest.

Monomorium aeyade n. sp.

Holotype: ♀, Oman, Wadi Aeyad, 20.III.1990, M.D. Gallagher. — Paratype: 1 ♀, same series as holotype.

Measurements of holotype: TL 1.5; HL 0.38; HW 0.31; CI 81.5; SI 96.8; HW/EL 0.24.

Description: These two tiny ants were taken from under a stone in sandy terrain. They resemble *M. guillarmodi* Arnold, 1946 from Lesotho by their small size and total absence of dorsal alitrunk hairs unlike all other known *Monomorium* species with 11-segmented antennae. The Arabian species differs from *M. guillarmodi* by the smaller eyes, the rounded anterior margin of the clypeus and the more rounded promesonotal dorsum. *M. guillarmodi* has 1-2 pairs of hairs on the occipital margin which are absent in *M. aeyade*. These two, somewhat unique, species are otherwise very similar both being glossy brown with very little sculpture.

Monomorium areniphilum Santschi, 1911 (Fig. 15)

Monomorium salomonis var. *areniphila* Santschi, 1911. — Bull. Soc. Hist. nat. Afr. Nord 3: 84.

Monomorium areniphilum. — Collingwood 1985; Fauna of Saudi Arabia 7: 269.

Material: Saudi Arabia: ♀♀ from: Wadi Hanifa, 30.I.1976; Wadi Shijah, 9.III.1977; Wadi Mutaywiyah, III.1977; Dammam, 18.V.1976; Bani Musayqirah, 16.X.1981; Al-Muraywah, 28.X.1986; all W. Büttiker. — Kuwait: ♀♀, ♀♀ from: Al-Rileg al-Shamali, 18.II.1988; Jabal Khartam, III.1988; Sulabiyah, 6.VII.1988; all W. Büttiker.

Measurements: TL 3.1-4.3; HL 0.86-1.04; HW 0.67-0.88; SL 0.68-0.88; CI 78-88; SI 98-104; EL/HW 0.30-0.35; from BOLTON (1987).

Anterior clypeal margin evenly concave; sides of head slightly and evenly rounded. Promesonotum evenly convex anteriorly becoming flat, then abruptly sloping to the deeply impressed mesopropodeal groove. Petiole node narrow in dorsal view but always slightly wider than long. Head with one or two pairs of hairs dorsally and always several ventrally behind and in addition to those below the mandible insertions. Occiput without projecting hairs. Dorsum of alitrunk bare except for some variable raised pubescence; petiole with one pair, postpetiole with 2-3 pairs of long

hairs. First gaster tergite without standing hairs anterior to the apical row. Dorsum of head with close reticulate sculpture with some fine striae centrally. Alitrunk reticulopunctulate with stronger punctate sculpture on the propodeum. Gaster moderately shining with superficial reticular patterning. Colour variable reddish brown to medium brown. This description is made from specimens collected in Tunisia, Morocco, Lebanon, Palestine as well as Arabia. All of these have short raised pubescence on the lower genae and alitrunk dorsum contrasting with an example from Niger which has no such pubescence, and a slightly broader petiole profile.

***Monomorium asiriense* n. sp. (Fig. 16)**

Monomorium abeillei. — Collingwood 1985; Fauna of Saudi Arabia 7: 269, pro parte [misidentification].

Holotype: ♀, Saudi Arabia, Bishah, 20°01'N 42°34'E, 7.IV.1983, C.A. Collingwood. — Paratypes: Saudi Arabia: 1 ♂, 1 ♀, ♀♀ from: Wadi Shuqub, 7.IV.1983; Bishah, 7.IV.1983; Al-Tawlah, 7.IV.1983; An-Naamah, 8.IV.1983; all C.A. Collingwood.

Measurements of holotype: TL 3.2; HL 0.73; HW 0.51; SL 0.51; range: CI 69-71; SI 100-102; EL/HW 0.285-0.323.

Description: The alitrunk is rather flat but with a sharp mesopropodeal break. The petiole node is a moderately high rounded cone. The clypeus has a distinct median incision. There is one pair of hairs on the pronotum, one on the petiole and one on the postpetiole; the first gastral tergite is bare. There are a few ventral hairs on the head. The head dorsum and alitrunk are densely punctulate but the nodes and gaster are shining with superficial sculpture.

The queen (measurements: HL 0.95-0.98; HW 0.79-0.81; SL 0.75-0.77; EL 0.27) has dense striatopunctulate sculpture on the head and alitrunk but the gaster is shining.

The male is pale and more delicately formed than that of *M. abeillei*, and has colourless legs and antennae.

Affinities: This species was attributed to *M. abeillei* in COLLINGWOOD (1985) but it is both paler in colour and more heavily sculptured.

***Monomorium baushare* n. sp.**

Holotype: ♀, Oman, Sad Baushar, 23°33'N 58°24'E, 2.I.1992, M.D. Gallagher. — Paratypes: Oman: ♀♀, same series as holotype. — Yemen: ♀♀ from: Rissabah, 8.X.1991; Wadi Surdud, 29.XI.1991; all A. van Harten. — Yemen: ♀♀, Hoddaida, Bajil, 15.III.1993, C.A. Collingwood.

Measurements of holotype: TL 1.40; HL 0.42; HW 0.30; SL 0.27; SI 90; EL 0.075 (eye with five ommatidia).

Description: This small ant has antennae with 11 segments and accords with the description of *M. exiguum* by BOLTON (1987) but the antennal scape is slightly longer (*M. exiguum* SI 74-84) and the body size larger. The body sculpture is smooth with a few punctures on the sides of the propodeum and some scratch marks on the head sides. The colour is pale brownish yellow.

***Monomorium bicolor* Emery, 1877**

Monomorium bicolor Emery, 1877. — Ann. Mus. civ. Stor. nat. Giacomo Doria 9: 368.

Material: United Arab Emirates: ♀♀, Umm al-Zamul, 10.X.1993, B. Tigar. — Oman: 1 ♀, Jiddat al-Harasis, 14.II.1988, M.D. Gallagher.

Measurements: HW 0.61-0.63; CI 74-80; SI 108-111; EL/HW 0.262.

This contrasted red and black species was misidentified in COLLINGWOOD (1985). Instead five new species have now been recognised having the same densely sculptured red head and alitrunk contrasted with the dark gaster. *M. bicolor* itself is a widely distributed African species but its Arabian distribution appears to be rather localised.

Monomorium brunneolucidulum n. sp.

Holotype: ♀, Oman, Qarhat Mu'ammarr, 2.II.1986, M.D. Gallagher. — Paratypes: 5 ♀♀, same series as holotype.

Measurements of holotype: TL 2.30; HL 0.70; HW 0.53; SL 0.61; CI 75.7; SI 115; EL/HW 0.28.

Description: In this species the mandibles are smooth with scattered hair pits unlike the species discussed so far. It appears to have some affinities with *M. oscaris* Forel, 1894 as well as the larger-eyed species of the *M. altinode* Santschi, 1910 complex. The clypeal ridges project over the mildly concave anterior border. The antennal scapes are long and reach over the occipital margin. The promesonotum is convex and rounds steeply to the mesopropodeal furrow and the propodeum is also strongly convex. The petiole is slightly wider than long in dorsal view, a rounded triangle in side view. There is one pair of occipital hairs, none on the pronotum, one pair of long hairs on the mesonotum plus a few short raised pubescent hairs. The petiole has one pair, the postpetiole three pairs and the first gastral tergite has ten pairs. The head is almost unsculptured with a slight reticulum and a few striae on the frons. The head, pronotum and gaster are brilliant with the mesopropodeum and nodes slightly more sculptured. The head and alitrunk are bright chocolate brown and the gaster dark brown.

Monomorium buettikeri n. sp.

Holotype: ♀, Kuwait, Anwha Island, 29°22'N 48°25'E, III.1988. W. Büttiker. — Paratypes: ♀♀, same series as holotype.

Measurements of holotype: TL 3.20; HL 0.81; HW 0.65; SL 0.70; range: CI 79-81; SI 107-111; EL/HW 0.30-0.33.

Description: The anterior clypeal margin is mildly concave. The eyes are relatively large with 11-12 ommatidia in the longest row. The scape just reaches the occipital border when laid back. The propodeal furrow is flat with slightly raised side margins, in profile with a distinctly rounded declivous face. The pronotum has no standing hairs but there are a few raised pubescent hairs on the mesonotum and the propodeum. The petiole has one pair of long hairs, the postpetiole two pairs and there are several long hairs on the gaster. The head and alitrunk have reticulopunctate sculpture throughout but the general appearance is shining and the gaster is brilliant. The colour is black with the appendages brown paling towards their extremities. *M. buettikeri* resembles *M. abeillei* in general appearance but is larger has a more sculptured head, a more rounded propodeal profile, larger eyes, longer antennae and absence of pronotal hairs.

Monomorium buxtoni Crawley, 1920

Monomorium buxtoni Crawley, 1920. — Ent. Rec. 32: 165.

Measurements: TL 3.2-3.4; HL 0.753; HW 0.59-0.61; SL 0.62-0.64; CI 78-83; SI 101-103; EL/HW 0.24-0.25.

This species was recorded from Kuwait and is known from Iraq and Iran but no recent Arabian specimens have been recognised in the present collections. There are 1-2 pairs of long hairs on the pronotum, two pairs each on the petiole and postpetiole and there are several hairs on the gaster and on the ventral head. The general colour is medium reddish brown. The propodeal furrow is distinct; the petiole is wider than long in dorsal view. The general appearance is more robust than in *M. abeillei*, the eyes are somewhat smaller and the antennal scapes are longer.

Monomorium carbo Forel, 1910

Monomorium salomonis var. *carbo* Forel, 1910. — Zool. Jb. Abt. Syst. 29: 251.

Monomorium carbo. — Bolton 1987; Bull. Br. Mus. nat. Hist. 54 (3): 339.

Material: Oman: 1 ♀, Mugshin Dhofar, 5.IX.1989, M.D. Gallagher.

Measurements: TL 2.5; HL 0.68; HW 0.495; SL 0.55; EL/HW 0.26; CI 72.8; SI 110.

The clypeal border is concave. The alitrunk profile is scarcely impressed by the weak mesopodeal furrow; the petiole is a blunt rounded triangle in profile. The only dorsal hairs include one pair on the petiole and a few scattered hairs on the gaster. There are no subcephalic hairs. The head, alitrunk and nodes have reticulopunctate sculpture and the first gaster tergite is shining with superficial reticulate sculpture. The only available specimen is slightly larger than in the description of Forel's specimens from Ethiopia in BOLTON (1987).

Monomorium chobauti Emery, 1896

Monomorium chobauti Emery, 1896. — Bull. Soc. ent. Fr. (1896): 418.

Material: Saudi Arabia: 1 ♀, Wadi Hanifa, XII.1977, W. Büttiker. — United Arab Emirates: ♀♀, Ras Ghanada, XI.1992, B. Tigar.

Measurements: HW 0.95-1.10; SI 80; EL/HW 0.20.

This reddish-yellow species is characterised by the abundant long ammochoete hairs forming a distinct psammophore. It is comparatively uncommon. It was first described from Algeria but is also known from Tunisia, the Middle East and Turkey.

Monomorium dammame n. sp.

Holotype: ♀, Saudi Arabia, Dammam, 26°24'N 50°11'E, 13.IX.1976, W. Büttiker. — Paratypes: Saudi Arabia: ♀♀, same series as holotype; ♀♀, Al-Khubra, 29.V.1978, W. Büttiker.

Measurements of holotype: TL 2.3; HL 0.80; HW 0.67; SL 0.71; EL/HW 0.34; range: CI 79-87; SI 100-115; EL/HW 0.34-0.365.

Description: The head in dorsal view is oval with rounded sides. The eyes are exceptionally large. The antennal scapes clearly over-reach the occipital margin when laid back and all funicular segments are longer than broad. The anterior clypeal margin is mildly convex with a small median incision. The dorsal alitrunk outline is rather flat with the mesonotum and propodeum meeting at a very wide angle. The petiole is a high, rounded, equilateral triangle in side view, 0.22 mm high. The pronotum has one pair of hairs, the petiole one pair and the postpetiole two pairs. The head and pronotum are glossy with weak reticulate sculpture, the sides of the mesopropodeum are more coarsely sculptured; the nodes and gaster are brilliant. The overall colour is pale yellowish brown.

Affinities: This species is similar in description to *M. vatranum* Bolton, 1987, but has distinctly larger eyes.

Monomorium dentigerum (Roger, 1862)

Atta dentigera Roger, 1862. — Berl. ent. Z. 6: 259.

Monomorium (Holcomyrme) dentigerum. — Emery 1921; Gen. Ins. 174: 181.

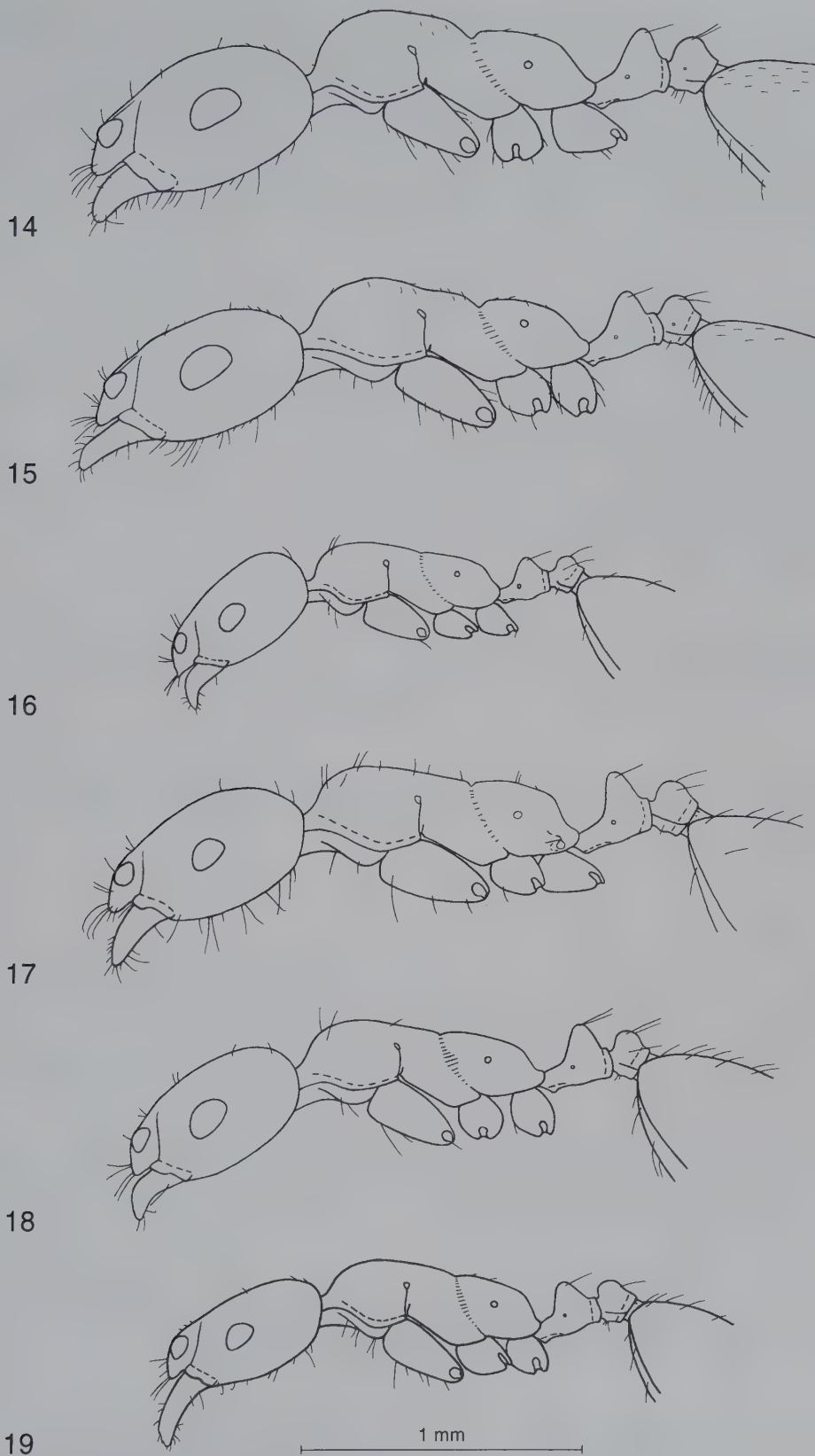
Material: Oman: ♀♀, Jabal Qara, 5.IX.1989, M.D. Gallagher.

This bicoloured species superficially resembles *M. destructor* but is easily distinguished by the narrow, indistinct antennal club and the slit-like propodeal spiracle. It occurs in southern Greece and the Middle East, and the Oman examples extend its range well to the south of previous records.

Monomorium desertorum n. sp.

Holotype: ♀, Saudi Arabia, sandy desert near Najran, 17°30'N 44°03'E, 10.IV.1983, C.A. Collingwood. — Paratypes: Saudi Arabia: 1 ♀, same series as holotype; ♀♀, Hofuf sandy desert, 14.IV.1983, C.A. Collingwood.

Measurements of holotype: TL 1.70; HL 0.50; HW 0.38; SL 0.36; CI 75; SI 96; EL/HW 0.24.



Figs 14-19: Head and alitrunk in profile: 14, *Monomorium acutinode* n. sp., ♀; 15, *M. areniphilum*, ♀; 16, *M. asiriense* n. sp., ♀; 17, *M. fayfaense* n. sp., ♀; 18, *M. hanage* n. sp., ♀; 19, *M. jizane* n. sp., ♀.

Description: This is a small yellow species overlooked in the previous paper. Unlike *M. qarabe* n. sp., *M. baushare* n. sp. and *M. aeyade* n. sp., there are 12 antennal segments. The eyes are set slightly forward of the midline; the scapes do not reach the occiput. The body is unsculptured except for scattered pinpoint punctures and metanotal cross-ribs. The clypeal ridges are not outstanding and do not project. In dorsal view the alitrunk appears more waisted than the other small yellow species and the head is slightly narrower. There are scattered hairs over the whole body and oblique hairs are present on the legs and antennae. The four specimens were each taken singly in sand.

***Monomorium destructor* (Jerdon, 1851)**

Atta destructor Jerdon, 1851. — Madras J. Lit. Sci. 17: 105.

Myrmica gracillima F. Smith, 1861. — J. Proc. Linn. Soc. Lond. 6: 31-35. [Synonymy by BOLTON 1987: 324].

Monomorium destructor. — Emery 1893; in: Dalla Torre, Cat. Hym. 7: 60.

Monomorium gracillimum. — Collingwood 1985; Fauna of Saudi Arabia 7: 270 [synonym].

This species abounds throughout Arabia and seems to occur in every type of habitat with many collections from Saudi Arabia, Oman and Yemen. This is one of the most successful pantropical species (WILLIAMS 1994).

***Monomorium dirie* n. sp.**

Holotype: ♀, Oman, Wadi Dir, 16.V.1984, M.D. Gallagher. — **Paratypes:** Oman: ♀♀, same series as holotype; ♀♀ from: Wahiba Sands, 14.XII.1985; Mintirib, 1.III.1986; all M.D. Gallagher.

Measurements of holotype: HL 0.95; HW 0.82; SL 0.85; EL 0.27 (15 ommatidia in the longest row).

Description: This species falls within the general description of *M. areniphilum* but the ventral head is entirely bare of hairs. The alitrunk profile is also flatter with a more shallow mesopropodeal furrow.

***Monomorium fayfaense* n. sp. (Fig. 17)**

Monomorium nitidiventre. — Collingwood 1985; Fauna of Saudi Arabia 7: 272, pro parte [misidentification].

Holotype: ♀, Saudi Arabia, Fayfa, 17°16'N 43°05'E, 27.III.1983, C.A. Collingwood. — **Paratypes:** Saudi Arabia: ♀♀, same series as holotype; ♀♀, Khama mangrove swamp, 1.IV.1983, C.A. Collingwood. — Yemen: ♀♀ from: Rissabah, 18.XI.1991; Wadi Surdud, 29.XII.1991; all A. van Harten.

Measurements of holotype: TL 3.0; HL 0.73; HW 0.58; SL 0.58; range: CI 82-87; SI 89-102; EL/HW 0.234-0.245.

Description: The head is broad with curved sides and emarginate occiput. The clypeus is emarginate. The mesopropodeal furrow is deep and the propodeal dorsum rounds steeply into its declivous face and has a wide longitudinal furrow with raised side margins. The petiole is relatively high and steep, transverse in dorsal view. There are several long hairs on the pronotum and a few short suberect hairs on the mesopropodeum and on the lower genae. The petiole has one pair and the postpetiole two pairs and there are scattered hairs on the first gastral tergite. The head, alitrunk and nodes are bright red and the gaster a strongly contrasted dark colour.

***Monomorium fezzanense* n. sp.**

Holotype: ♀, Saudi Arabia, Jabal Banban, 16.III.1978, W. Büttiker. — **Paratypes:** Saudi Arabia: ♀♀, same series as holotype; ♀♀, N of Tabuk, 4.IV.1979; Exp. N. Hedjaz (W. Büttiker); ♀♀, Al-Tawlah, 7.III.1983, C.A. Collingwood. — Oman: ♀♀, Khabura Batina, 2.VI.1979, R.P. Whitcombe; ♀♀, Thumrait, IV.1984, J.M. Barnes.

Measurements of holotype: HL 0.87; HW 0.71; SL 0.73; EL 0.23.

Description: This species has a narrow petiole, not wider than long in dorsal view. There are no suberect pubescent hairs. The head, alitrunk and nodes are densely punctate and the gaster has close reticulopunctate sculpture so that the whole body is dull. The head, nodes and gaster are dark at least in part, contrasting with the paler alitrunk giving a distinctive bicoloured appearance. SANTSCHI (1936) described this form from Libya but it also occurs in other North African countries and in the Middle East.

Monomorium gallagheri n. sp.

Holotype: ♀, Oman, Qarhat Mu'amar, 1.II.1986, M.D. Gallagher. — **Paratypes:** Oman: ♀♀, same series as holotype. — Saudi Arabia: ♀♀, Wadi Awsat, 31.XII.1974, W. Büttiker.

Measurements of holotype: TL 2.53; HL 0.88; HW 0.56; SL 0.57; EL 0.145; range: CI 77.8-84.3; SI 99.5-112; EL/HW 0.265-0.312.

Description: The clypeal border is weakly convex with a small median incision. The alitrunk profile is flat with the mesonotum meeting the propodeum at an oblique angle. The propodeal furrow is distinct with well-defined side margins. The petiole node is a rounded triangle in side view. There are no hairs on the underside of the head away from the maxillae. The pronotum has one pair of hairs, the petiole one pair and the postpetiole two; the gaster has several on the first tergite. Head, alitrunk and nodes have evenly punctate sculpture; the gaster is shining with a faint reticulation. The body colour is uniformly medium brown.

Affinities: This species is similar to *M. delagoense* Forel, 1894, but smaller and has larger eyes (*M. delagoense* EL/HW 0.22-0.245).

Monomorium hanaqe n. sp. (Fig. 18)

Holotype: ♀, Saudi Arabia, Wadi Hanaq, 22°49'N 39°22'E, 31.I.1985, W. Büttiker. — **Paratypes:** Saudi Arabia: 1 ♀, ♀♀, same series as holotype; ♀♀, Abu Arish, 2.IV.1983, C.A. Collingwood. — Yemen: ♀♀, Wadi Surdud, 29.XII.1991, A. van Harten.

Measurements of holotype: TL 3.10; HL 0.71; HW 0.53; SL 0.59; EL/HW 0.304; CI 74; SI 113. Paratype queen: TL 6.5; HW 0.84; SL 0.72; EL 0.32.

Description: The head is nearly rectangular with almost straight sides but rounded occipital corners. The mesopropodeal break is distinct but scarcely interrupts the dorsal outline. The petiole is moderately high but narrow in dorsal view, not wider than the postpetiole. There is one pair of hairs on the propodeum, one pair on the petiole, two pairs on the postpetiole and the gaster has some scattered hairs. The head and alitrunk have dense punctulate sculpture but the gaster is somewhat shining with superficial reticulate sculpture. The head and alitrunk are dull red and the gaster is brown not black. This species is distinguished by the duller red colour, the relatively long scapes which reach the occiput and the large eyes. The single associated paratype queen has more dense sculpture, more body hairs and a higher cone-shaped petiole.

Monomorium harithe n. sp.

Holotype: ♀, Saudi Arabia, Harithi, 19.IV.1985, W. Büttiker. — **Paratypes:** Saudi Arabia: ♀♀, same series as holotype; 1 ♀, ♀♀, Riyadh, 21.I.1980, A.H. Talhouk. — Yemen: ♀♀, Taiz – Aden, 20.III.1993, C.A. Collingwood.

Measurements of holotype: TL 2.75; HL 0.65; HW 0.51; SL 0.53; EL/HW 0.29; CI 78.5; SI 103.

Description: The clypeus is mildly convex with a small median incision. The head sides are distinctly rounded the occipital border slightly emarginate. The alitrunk is rather flat with the propodeum falling away from the mesonotum at the shallow mesopropodeal break. The propodeal furrow is distinct with slightly raised margins. There are no alitrunk hairs, one pair on the petiole,

one on the postpetiole and two pairs on the first gastral tergite in front of the apical row. The head and alitrunk have scattered punctures within a superficial reticulum with the nodes and propodeum more strongly sculptured. The colour is evenly dark reddish brown and the general appearance somewhat shining, not dull as in the similar *M. phoenicium*.

Monomorium hemame n. sp.

Holotype: ♀, Kuwait, Umm al-Hemam, 9.III.1988, W. Büttiker. — Paratypes: Kuwait: ♀♀, same series as holotype. — Saudi Arabia: ♀♀, Uyaynah, 1.IV.1976, W. Büttiker.

Measurements of holotype: HL 0.91; HW 0.755; SL 0.77; EL 0.23; CI 83; SI 102; EL/HW 0.31.

Description: This species differs from *M. areniphilum* by having a double row of hairs on the first gastral tergite anterior to the apical row and the gaster is black rather than brown, contrasting with the reddish-brown head and alitrunk. The ventral head hairs are also more abundant. The petiole is narrow in dorsal view, not wider than long.

Monomorium jizane n. sp. (Fig. 19)

Monomorium nitidiventre. — Collingwood 1985; Fauna of Saudi Arabia 7: 272, pro parte [misidentification].

Holotype: ♀, Saudi Arabia, Jizan, Abu Arish, 2.IV.1983, C.A. Collingwood. — Paratypes: Saudi Arabia: ♀♀, same series as holotype; ♀♀, Wadi ad-Dilla, Jizan, 22.IV.1975, W. Büttiker; ♀♀, Najran, 7.IV.1983, C.A. Collingwood. — Oman: ♀♀, Tibat Musandham, 24.IX.1984, M.D. Gallagher. — Yemen: ♀♀ from: Rissabah, 8.X.1991; Taiz, 20.X.1991; all A. van Harten.

Measurements of holotype: TL 2.50; HL 0.64; HW 0.47; SL 0.50; EL/HW 0.27; range: CI 72-76; SI 96-103; EL/HW 0.25-0.29.

Description: The clypeal border is narrowly emarginate or with a small incision in a rather straight outline. The head is long, rectangular with slightly curved sides and a slightly emarginate occiput. The eyes are relatively large with 8-9 ommatidia in the longest row. The antennal scapes just fail to reach the occipital border. The alitrunk has a narrow deep mesopropodeal break; the propodeal furrow is long and distinctly margined as in *M. nitidiventre*. The petiole is a rounded triangle in profile and narrow in dorsal view at least as long as wide. The occiput has a projecting hair near each corner. There is one pair on the pronotum, one pair on the petiole, one or two pairs on the postpetiole and six pairs on the first gastral tergite in front of the apical row. The whole body has dense punctate sculpture with only the sides of the gaster shining. The punctures on the propodeum are arranged in close transverse rows on the descending face. The head, alitrunk and nodes are medium orange red, contrasting with the uniformly black gaster.

Affinities: This species differs from *M. hanae* n. sp. by its smaller size, brighter colour, shorter scape, smaller eyes and lower petiole.

Monomorium knappi n. sp. (Fig. 20)

Holotype: ♀, Yemen, Wadi Hadramaut, 24.III.1993, M. Knapp. — Paratypes: ♀♀, same series as holotype.

Measurements of holotype: TL 2.9; HL 0.86; HW 0.63; SL 0.62; EL/HW 0.20; CI 73.8; SI 98.4.

Description: The head, alitrunk and nodes have close reticulate sculpture as in *M. yemene* n. sp. and *M. fayfaense* n. sp., but the gaster is shining with a superficial reticulate sculpture as in *M. nitidiventre*. There are three pairs of hairs on the pronotum, one on the mesonotum, one on the propodeum, one on the petiole, two on the postpetiole and eight pairs on the first gastral tergite. The petiole is high and thin in profile, wider than long in dorsal view. The head is relatively narrow and the eyes small.

Monomorium luteum Emery, 1881

Monomorium luteum Emery, 1881. — Ann. Mus. civ. Stor. nat. Giacomo Doria 16: 532.

Material: Yemen: ♀♀, near Zingibar, 23.III.1993, A. van Harten.

Measurements: TL 4.0-4.2; HL 113-115; HW 0.76-0.78; SL 1.10-1.13; CI 66.1; SI 1.140-1.147; EL/HW 0.323.

This is the largest of the Arabian *Monomorium* species. The head is very long; the antennal scapes are very long; the alitrunk is flat with a shallow oblique mesopropodeal furrow and the petiole is low with a smoothly rounded dorsum. The pronotum has one pair of hairs, the mesonotum one pair, the petiole one pair, the postpetiole two pairs and the first gaster tergite has seven pairs of long hairs. The general aspect is moderately shining with superficial reticulate sculpture becoming coarser on the propodeum. The general body colour is pale brownish yellow.

Monomorium mahyoubi n. sp.

Holotype: ♀, Yemen, Taiz – Al-Turbah, roadside, 14.III.1993, C.A. Collingwood. — Paratypes: Yemen: ♀♀, same series as holotype; ♀♀, Sana'a, 17.III.1993, C.A. Collingwood.

Measurements of holotype: TL 2.8; HL 0.66; HW 0.57; SL 0.62; CI 86; SI 99-100; EL/HW 0.27.

Description: The pronotum has one pair of erect hairs, the mesonotum up to two pairs, the petiole and postpetiole each have two pairs and the first gastral tergite has 8-10 pairs. The head, alitrunk and nodes are coarsely punctate, the gaster less densely but distinctly sculptured so that the whole body is dull without shine. The colour is dark brownish black. The clypeal margin is incised in the middle and the clypeal ridges are relatively sharp.

Affinities: This species resembles *M. suleyile* n. sp. but is smaller, darker and has larger eyes.

Monomorium majarishe n. sp.

Holotype: ♀, Saudi Arabia, Wadi Majarish, 21°23'N 40°15'E, 17.II.1983, W. Büttiker. — Paratypes: ♀♀, same series as holotype.

Measurements of holotype: TL 1.95; HL 0.49; HW 0.38; SL 0.35; EL/HW 0.24; range: CI 78.5-79; SI 90-92.

Description: The clypeus is emarginate. The eyes with six ommatidia in the longest row are set slightly forward of the mid length of the head. The alitrunk in profile shows no dip in the dorsal outline, the mesopropodeal break appearing as a simple line. There are no dorsal hairs on the alitrunk or nodes. The head has no well-defined sculpture and that of the alitrunk dorsum, nodes and lower face of the first gastral tergite is punctate but not dense. The colour is dull greyish yellow.

Affinities: This species appears close to *M. osiridis* Bolton, 1987, but the head sculpture lacks the characteristic median shining strip of *M. osiridis* and the eyes are slightly larger. This was wrongly identified as *M. schultzei* Forel, 1910 in COLLINGWOOD (1985) but that species has not been confirmed for Arabia.

Monomorium marmule n. sp. (Fig. 21)

Holotype: ♀, Oman, Marmul, IX.1989, M.D. Gallagher. — Paratypes: Oman: ♀♀, same series as holotype; ♀♀ from: Yalooni, 3.X.1984; Mintirib, 14.I.1986; all M.D. Gallagher; ♀♀, Yalooni, 18.XI.1984, R. Braund.

Measurements of holotype: HL 0.97; HW 0.80; SL 0.84; EL 0.24; PW 0.26.

Description: This species differs from *M. areniphilum* by the wide transverse nodes both of which are clearly wider than long. The petiole is also rather high in profile, 0.30 mm. Suberect pubescent hairs are present over the alitrunk dorsum and gaster but no long hairs except one pair

on the petiole and two pairs on the postpetiole. The head and alitrunk are reddish brown but both nodes are infusate dorsally and the antennae darken towards their tips. This species is also less sculptured and more brightly coloured than *M. areniphilum*.

Monomorium matame n. sp. (Fig. 22)

Holotype: ♀, Oman, Wadi Matam, 1.II.1986, M.D. Gallagher. — Paratypes: Oman: ♀♀, same series as holotype. — Saudi Arabia: 1 ♀, Nuayriyah, 20.V.1980, W. Büttiker. — Yemen: ♀♀, Sana'a, II.1991, A. van Harten.

Measurements of holotype: HL 1.10; HW 0.91; SL 1.05; EL 0.31; CI 80-84; SI 111-115.

Description: The pilosity and sculpture are similar to *M. niloticum* but the eyes are larger, EL/HW 0.325-0.34, and the colour different. The head and antennal clubs are brownish, contrasting with the lighter alitrunk whereas in the very large number of *M. niloticum* specimens from Arabia the pale reddish colour of the head, alitrunk, antennae and legs is consistent.

Monomorium mayri Forel, 1902

Monomorium gracillimum var. *mayri* Forel, 1902. — Rev. Suisse Zool. 10: 209.

Monomorium karawajewi. — Collingwood 1985; Fauna of Saudi Arabia 7: 270. n. syn.

Material: Yemen: ♀♀ from: Sana'a, I.1991 and XI.1991; Aden, XII.1991; all A. van Harten.

The Yemen records are new for that country and are additional to the many collections from Saudi Arabia and Oman where this species seems to be almost as common as *M. destructor* from which it only differs in the darker colour. Bright yellowish workers of *M. destructor* can be distinguished easily from the darker samples of *M. mayri* but there are less determinate specimens of greyish colour suggesting that either the two species hybridise or in fact form a continuum of colours from bright yellow, red yellow, greyish to black.

Remarks: BOLTON (1987: 326) treated *M. karawajewi* as a non-available name, although COLLINGWOOD (1985: 270) made *M. karawajewi* sensu Forel, 1913 an available name at species level. However, this does not change the synonymy.

Monomorium mintiribe n. sp. (Fig. 23)

Holotype: ♀, Oman, Mintirib, 17.XI.1984, M.D. Gallagher. — Paratypes: Oman: ♀♀, same series as holotype; 1 ♂, ♀♀, Bilad Bani, 20°03'N 59°17'E, W. Büttiker; ♀♀ from: Mugshin Dhofar, 5.IV.1984; Yalooni, 3.X.1984; Wadi Ibra, 17.I.1988; all M.D. Gallagher. — Saudi Arabia: ♀♀, Al-Kola, 10.IV.1983, C.A. Collingwood.

Measurements of holotype: TL 2.5; HL 0.69; HW 0.55; SL 0.55; range: CI 79; SI 99-103; EL/HW 0.27-0.30.

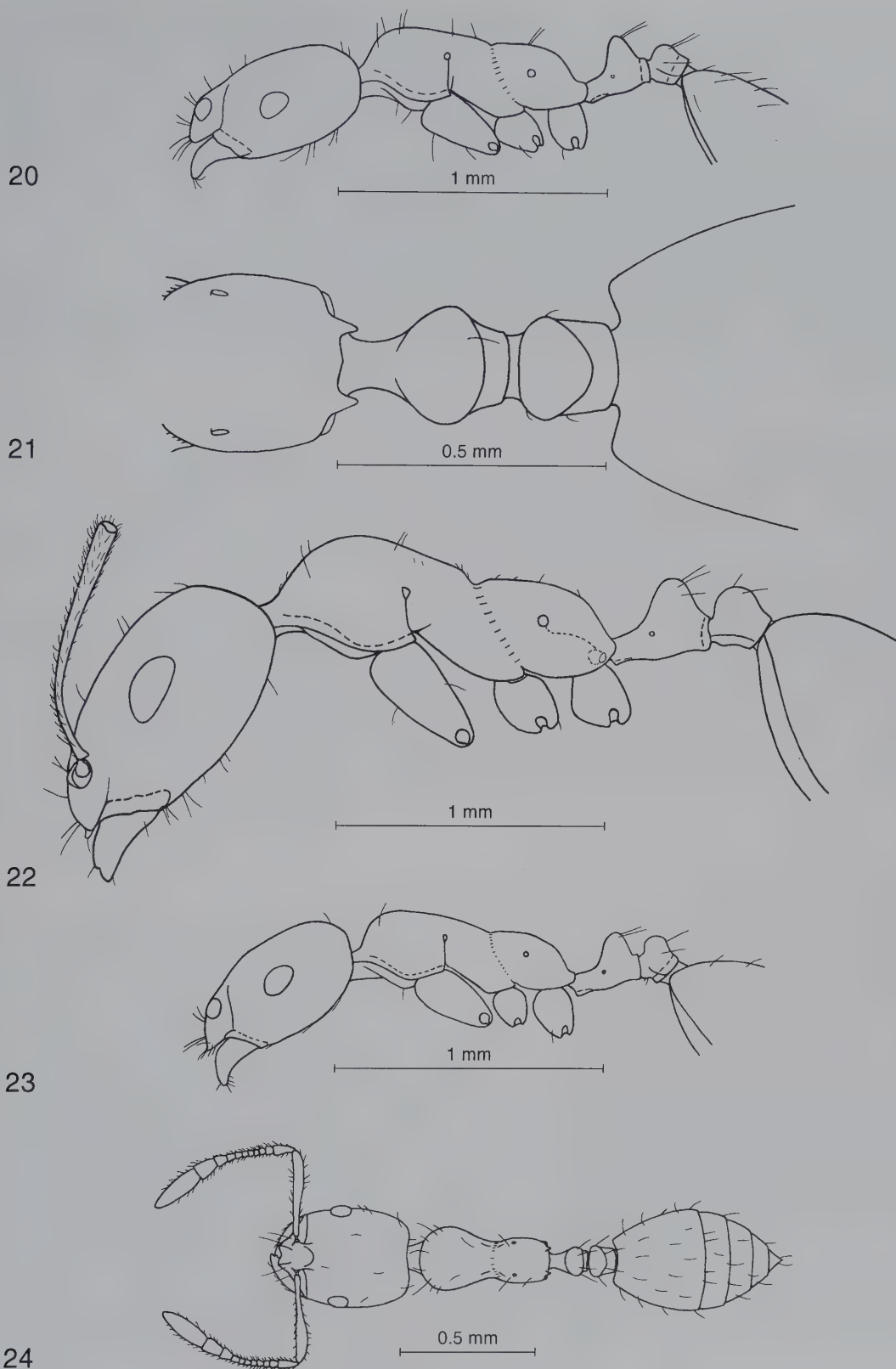
Description: Clypeus with straight anterior border; alitrunk low with a shallow mesopropodeal break and a distinct long propodeal furrow. Petiole a high rounded cone more than 0.21 mm high in full profile. There are one or two pairs of hairs on the pronotum, one pair on the petiole and one on the postpetiole. There are a few hairs on the gaster and on the ventral head and also on the lower genal margins. Raised pubescent hairs are present on the propodeum. The head and alitrunk are shining with uniform shallow punctulate sculpture and the shining gaster has weak reticulate sculpture. The colour is evenly light to medium brown.

Monomorium montanum n. sp. (Fig. 24)

Monomorium zulu. — Collingwood 1985; Fauna of Saudi Arabia 7: 273 [misidentification].

Holotype: ♀, Saudi Arabia, Sawdah Mt., 2500 m, 18°17'N 42°23'E, 9.IV.1983, C.A. Collingwood. — Paratypes: Saudi Arabia: ♀♀, same series as holotype; ♀♀ from: Sanam, 28.VI.1980; Wadi Azizah, 18.IX.1983; all W. Büttiker; ♀♀ from: Bishah, 7.IV.1983; An-Naamah, 8.IV.1983; all C.A. Collingwood.

Measurements of holotype: TL 2.20; HL 0.51; HW 0.40; SL 0.34; EL 0.095; range: TL 1.7-2.3; CI 77.4-79.3; SI 88.6-90.4; EL/HW 0.255.



Figs 20-24: 20, *Monomorium knappi* n. sp., ♀, head and alitrunk in profile; 21, *M. marmule* n. sp., ♀, petiole and postpetiole in dorsal view; 22, *M. matame* n. sp., ♀, head and alitrunk in profile; 23, *M. mintiribe* n. sp., ♀, head and alitrunk in profile; 24, *M. montanum* n. sp., ♀, dorsal view.

Description: The mandibles are unstriated. The clypeus is emarginate with the ridges projecting forward as two small denticles. The basal tooth is slightly offset. The dorsal outline of the alitrunk is flat with the propodeum rounding steeply into the near-vertical descending face. The mesopropodeal furrow is sharp and distinct but too small to break the dorsal outline. The petiole is a high rounded cone. There is one pair of curved hairs on the pronotum, several on the mesopropodeum and gaster and two pairs each on the petiole and postpetiole. Body sculpture is absent except for scattered hair pits, metanotal cross-ribs and faint marks on the sides of the mesopropodeum. The general appearance is shining yellow.

Affinities: This species was wrongly attributed to *M. zulu* Santschi, 1914 in COLLINGWOOD (1985), a species of similar size and colour but belonging to the *M. salomonis* group and not, as with this species, the *M. monomorium* group. *M. montanum* is similar to *M. tynsorum* Bolton, 1987 of Angola but has larger eyes.

Monomorium najrane n. sp.

Monomorium subopacum. — Collingwood 1985; Fauna of Saudi Arabia 7: 272, pro parte [misidentification].

Holotype: ♀, Saudi Arabia, desert near Najran, 17°32'N 44°00'E, 10.IV.1983, C.A. Collingwood. — **Paratypes:** Saudi Arabia: ♀♀, same series as holotype; ♀♀ from: Hofuf desert area, 11.IV.1983; Al-Baix, 11.IV.1983; all C.A. Collingwood.

Measurements of holotype: TL 2.2; HL 0.57; HW 51; SL 0.54; EL/HW 0.34; range: CI 77-88; SI 93-94; EL/HW 0.31-0.36.

Description: The clypeal margin is concave; the scapes reach the occipital border. The mesopropodeal furrow is shallow but distinct. The petiole is broadly rounded in profile. There are no hairs on the alitrunk dorsum, one pair on the petiole and one pair on the postpetiole. The gaster has several dorsal hairs. The sculpture of the whole body is densely reticulopunctate giving a very dull opaque appearance. The body colour is black.

Affinities: This species resembles *M. micropacum* Bolton, 1987, but has much larger eyes.

Monomorium niloticum Emery, 1881 (Fig. 25)

Monomorium niloticum Emery, 1881. — Ann. Mus. civ. Stor. nat. Giacomo Doria 16: 531.

Measurements: HW 0.80-0.88; CI 77-85; SI 100-120; EL/HW 0.285-0.32.

The head is somewhat rectangular in shape but narrowing above the eyes to the widely emarginate occiput. The rather flat mesonotum falls obliquely to the broad and deep mesopropodeal furrow. The propodeal dorsum is at a lower level than the mesonotum with the convex dorsum rounding smoothly into the descending face. The propodeal furrow is well defined with raised side margins. There are 3-4 pairs of hairs on the pronotum, 4-5 on the mesonotum, two on the propodeum, two on the petiole, three on the postpetiole and 6-7 on the first gastral tergite. The head and promesonotum have superficial sculpture with a general shining appearance; the propodeum is punctate with a transverse striate effect. Head, alitrunk and nodes are pale red with the gaster usually darker. This is the most conspicuous and abundant of the larger *Monomorium* species throughout western and central areas of Saudi Arabia, Oman and Yemen. It is not recorded from Kuwait or eastern coastal areas of Arabia and seems not to occur in desert sands away from townships, agricultural and irrigated areas. There is some variation in dorsal pilosity but the alitrunk always has several pairs of hairs.

Monomorium nitidiventre Emery, 1893

Monomorium bicolor nitidiventre Emery, 1893. — Ann. Soc. ent. Fr. 62: 256.

Monomorium nitidiventre. — Collingwood 1985; Fauna of Saudi Arabia 7: 272.

Material: Saudi Arabia: ♀♀ from: Wadi Dhyan, IV.1983; Wadi Qust, 7.IV.1983; Abu Arish, 27.III.1983; all C.A. Collingwood. — Kuwait: ♀♀, Umm al-Rumam, 18.II.1988, W. Büttiker. — Yemen: ♀♀ from: Sana'a, VIII.1991; Rissabah, 8.IX.1991; all A. van Harten.

Measurements: HL 0.75-0.90; HW 0.67-0.91; SL 0.61-0.76; CI 89; SI 90.

The clypeus is widely emarginate. The propodeal furrow is exceptionally well defined with raised side margins. The alitrunk profile is flat with the mesopropodeal furrow distinct but shallow. There are no alitrunk hairs, one pair on the petiole, 1-2 pairs on the postpetiole and occasional hairs on the first gastral tergite. The head and alitrunk have dense reticulopunctate sculpture. The gaster is shining with superficial sculpture, black in whole or in part but well contrasted with the red head, alitrunk and nodes. The Arabian examples are larger than those from Greece but the two populations cannot be distinguished on morphology or colour. This species was misinterpreted and partly misidentified in COLLINGWOOD (1985).

Monomorium phoenicium Santschi, 1927

Monomorium (Xeromyrmex) subopacum var. *phoenicium* Santschi, 1927. — Bull. Ann. Soc. ent. Belg. 67: 242.

Monomorium phoenicium. — Collingwood 1985; Fauna of Saudi Arabia 7: 272.

Material: Saudi Arabia: ♀♀ from: Jeddah, 25.III.1978; Mawqaq, 4.V.1985; all W. Büttiker. — Oman: 1 ♀, Umm Qashrab, 2.VII.1986, M.D. Gallagher.

Measurements: Mean HW 0.642; CI 77.8; SI 118.7; EL/HW 0.275.

The clypeus is emarginate. The antennal scape just reaches the occipital border. The head is comparatively long with gently curved sides and a weakly emarginate occipital border. The alitrunk is high with the promesonotal dorsum curving to the shallow mesopropodeal break. The propodeum has the dorsal face rounding steeply into the declivous face. The propodeal furrow is always distinct with raised margins. There are some subcephalic hairs, one pair on the petiole, one pair on the postpetiole and a few scattered hairs on the gaster. The whole body is densely punctate. The colour varies in different populations from reddish to various shades of brown. This species resembles *M. subopacum* from the Mediterranean area but differs in the impressed propodeal furrow and the denser head sculpture.

Monomorium qarabe n. sp.

Holotype: ♀, Saudi Arabia, Qarah Village, 18°03'N 42°45'E, 16.IV.1976, W. Büttiker. — **Paratype:** 1 ♀, same series as holotype.

Measurements of holotype: TL 2.0; HL 0.51; HW 0.40; SL 0.37; CI 79; SI 92.5; EL 0.10.

Description: The head is rectangular with the clypeus emarginate. The clypeal ridges project as short blunt denticles. The mesopropodeal break is shallow; the petiole is a broadly rounded triangle. There are long hairs round the occiput and head sides. The pronotum has one pair of hairs, the mesonotum two, the propodeum one and the petiole and postpetiole each have two pairs. The whole body is smooth bright yellow with only indistinct surface sculpture. It differs from *M. montanum* n. sp. in the ring of head hairs, the lower propodeum and lower broader petiole. The specimens were taken on high ground at 2000 m.

Monomorium rimae n. sp.

Holotype: ♀, Yemen, Wadi Rima near Madinat al-Shariq, 12.III.1992, A. van Harten. — **Paratypes:** ♀♀, same series as holotype.

Measurements of holotype: TL 1.80; HL 0.44; HW 0.37; SL 0.25; CI 84.1; SI 70.2.

Description: This small species resembles *M. nuptialis* Forel, 1913 but has a much shorter scape and is distinctively bicoloured with a glossy black gaster and brown head contrasting with

the yellow alitrunk and nodes. The funiculus segments 2-9 are transverse. The clypeus is broadly emarginate with raised ridges. Scattered dorsal hairs are present on the head and alitrunk and the whole body is unsculptured except for a few punctures at the sides of the propodeum and at the shallow mesopropodeal break.

Monomorium riyadhe n. sp. (Fig. 26)

Holotype: ♀, Saudi Arabia, Riyadh Agricultural Station, 26.III.1983, C.A. Collingwood.

Measurements of holotype: TL 3.8; HL 0.97; HW 0.73; SL 0.84; EL 0.26; CI 74; SI 114; EL/HW 0.355.

Description: The general appearance is as *M. niloticum* but with fewer alitrunk hairs. One pair on the pronotum, one on the mesonotum, one on the propodeum, one on the petiole and one on the postpetiole. The main difference is in the sculpture. The whole head is striate including the sides where the striae are continuous from the mandibles to the occiput. Longitudinal striae also reappear on the propodeum but the promesonotum and the first gastral tergite have reticulo-punctate sculpture. The back of the head, descending face of the propodeum and the dorsum of the nodes are punctate. The head is comparatively long, almost rectangular and the eyes are large with 16 ommatidia in the longest row.

Monomorium robustior Forel, 1892

Monomorium gracillimum r. *robustior* Forel, 1892. — Mitt. Schweiz. ent. Ges. 8: 352.

Monomorium robustior. — Bolton 1987; Bull. Br. Mus. nat. Hist. Ent. 54: 328.

Material: Saudi Arabia: ♀♀, Wadi al-Ammariyah, XII.1977, W. Büttiker. — Oman: ♀♀, Al-Khuwayr, IX.1989, M.D. Gallagher. — Yemen: ♀♀, Wadi Surdud, 29.XII.1991, A. van Harten.

This species is similar in colour to *M. mayri* but lacks the occipital transverse striae characteristic for both *M. destructor* and *M. mayri*, has larger eyes and is less polymorphic than those species.

Monomorium salomonis (Linnaeus, 1758)

Formica salomonis Linnaeus, 1758. — Syst. Nat. ed. 10, 1: 580.

Monomorium salomonis. — Roger 1862; Berl. ent. Z. 6: 294.

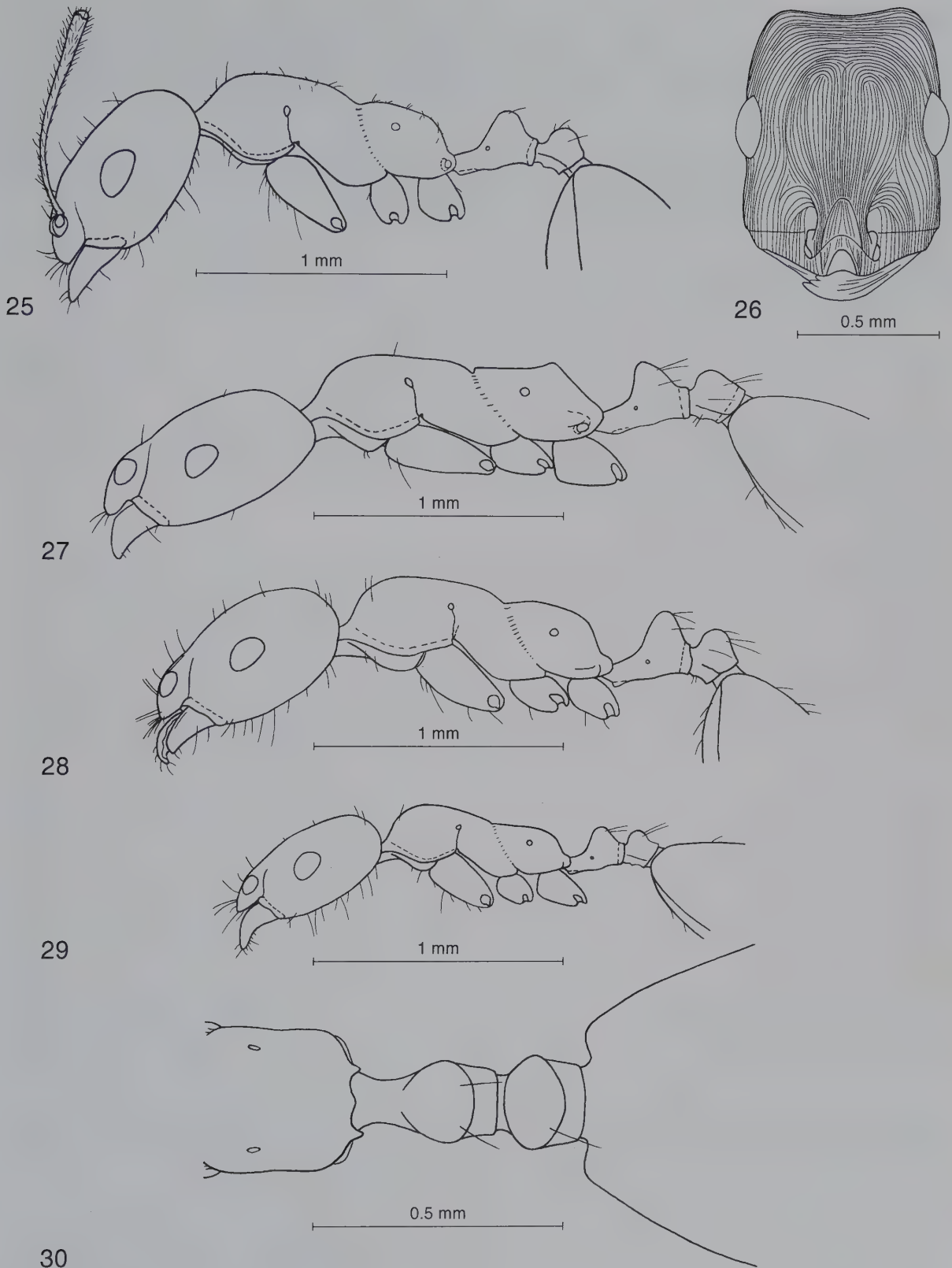
This common North African species seems to be rather local outside the Mediterranean area. There are no new records for Arabia but there are a number of related species with larger eyes within the *M. areniphilum/venustum* group, that have eyes at least 0.3 times HW with 11 or more ommatidia in the longest row, a deep mesopropodeal break, an evenly concave anterior clypeal border and a total absence of dorsal alitrunk hairs. All head indices fall within the same parameters as given by BOLTON (1987) for *M. areniphilum* so these cannot be used to distinguish the two species.

Monomorium subdenticorne n. sp. (Fig. 27)

Holotype: ♀, Yemen, Al-Mahwit, 21.IX.1991, A. van Harten. — Paratypes: Yemen: ♀♀, same series as holotype; ♀♀ from: Taiz – Mafhaq, 15.III.1993; Wadi Bani, 20.III.1993; all C.A. Collingwood; ♀♀, Mabab, IV.1993, M. Knapp.

Measurements of holotype: TL 3.6; HL 0.82; HW 0.71; SL 0.75; EL/HW 0.216; CI 88; SI 106.

Description: The clypeus is broadly emarginate, the head emarginate with distinct occipital corners and broadly curved sides. The mesopropodeal break is short but deep. The propodeal dorsum is long and flat but raised posteriorly and angled so as to form two blunt, slightly projected dentiform bosses. The propodeal furrow is both broad and deep. There are no dorsal alitrunk hairs,



Figs 25-30: 25, *Monomorium niloticum*, ♀, head and alitrunk in profile; 26, *M. riadhe* n. sp., ♀, head in dorsal view; 27, *M. subdenticorne* n. sp., ♀, head and alitrunk in profile; 28, *M. suleyile* n. sp., ♀, head and alitrunk in profile; 29, *M. tumaire* n. sp., ♀, head and alitrunk in profile; 30, *M. venustum*, ♀, petiole and postpetiole in dorsal view.

one pair on the petiole, one on the postpetiole and two pairs on the first gastral tergite anterior to the apical row. There are also short suberect pubescent hairs on the mesopropodeum and gaster. The head, alitrunk and nodes have dense reticulopunctate sculpture; the gaster is shining with superficial reticulate sculpture. The head, alitrunk and nodes are pale brownish red contrasting with the dark gaster.

Affinities: In general appearance this species resembles *M. nitidiventre* apart from the dentiform propodeum and duller colour and is lighter in colour and has a broader head than *M. subdentatum* Forel, 1913 from Zaire.

Monomorium subopacum (Smith, 1858)

Myrmica subopacum F. Smith, 1858. — Cat. Hym. Brit. Mus. 6: 127.

Monomorium subopacum. — Mayr 1862; Verh. zool.-bot. Ges. Wien 12: 753.

Material: Oman: 1 ♀, Tibat Musandham, 24.X.1984, M.D. Gallagher. — Yemen: ♀♀, Sid el Feyhn, 10.VI.1992, M. Knapp.

Measurements: HW 0.60; CI 78; SI 105; EL/HW 0.28.

The Najran record in COLLINGWOOD (1985) should refer to *M. najrane* n. sp. as described above and this species is not known from Saudi Arabia.

Monomorium suleyile n. sp. (Fig. 28)

Holotype: ♀, Saudi Arabia, Suleyil desert, 11.IV.1983, 25°40'N 45°50'E, C.A. Collingwood. — **Paratypes:** Saudi Arabia: 1 ♂, ♀♀, ♀♀ from: same series as holotype; Hofuf, 13.IV.1983; Al-Qatif, 14.IV.1983; Riyadh, 17.IV.1983; all C.A. Collingwood. — Oman: ♀♀ from: Barr al-Hickman, 12.II.1987; Jabal Maram, 27.II.1990; all M.D. Gallagher.

Measurements of holotype: TL 3.2; HL 0.84; HW 0.70; SL 0.73; EL/HW 0.25; range: CI 83-87; SI 99-110.

Description: This species is similar to *M. junodi* Forel and would key to that species in BOLTON (1987). However, worker specimens differ in the longer antennal scapes and slightly larger eyes (*M. junodi* SI 85-100; EL/HW 0.22-0.25). The mesopropodeal furrow is deeply impressed. The head and alitrunk have close punctate sculpture which is arranged linearly on the propodeum, giving a transverse striate effect. The gaster is also densely punctate and dull. The petiole is a rather high but thick triangular cone in profile with the posterior face nearly flat and the anterior face more broadly curved. The worker pilosity is somewhat variable; some examples have more than one pair of pronotal hairs and occasional shorter hairs may be present on the mesonotum and the propodeum. The alitrunk is more massive than in the other species of this group with the declivous face of the propodeum correspondingly steeper. Body colour is brown with the gaster dorsum slightly darker.

The queen (HL 1.10; HW 1.52) has the head, most of the alitrunk and gaster densely sculptured and dull. Much of the dorsal mesonotum is longitudinally striate and less densely sculptured. The head is very broad with large eyes and ocelli.

The male is black, comparatively robust and has close punctate sculpture. This species was wrongly referred to *M. afrum* André, 1884 in COLLINGWOOD (1985), a species with a very different head shape and no dorsal alitrunk hairs but of rather similar size and colour.

Monomorium tumaire n. sp. (Fig. 29)

Holotype: ♀, Saudi Arabia, Wadi Tumair, 25°43'N 45°51'E, 20.II.1976, W. Büttiker. — **Paratypes:** Saudi Arabia: ♀♀, same series as holotype. — United Arab Emirates: ♀♀, Ras Ghanada, IX.1992, B. Tigar. — Oman: ♀♀, Eastern Sands, Mintirib, II.1986, W. Büttiker.

Measurements of holotype: TL 2.56; HL 0.61; HW 0.56; SL 0.56; EL/HW 0.287; range: CI 79-85; SI 100-106.

Description: Clypeus weakly emarginate; head with sides mildly curved and rounded occipital corners. Dorsal outline of alitrunk with a shallow mesopropodeal break, the mesonotum rising from the propodeum at a very gentle slope becoming flat to its junction with the pronotum. The petiole is a thick rounded triangle. The propodeal furrow is distinct and mildly margined. There are two pairs of occipital hairs, abraded in some specimens, 12-16 hairs on the ventral surface of the head, some longer than the maximum eye length. The pronotum has one pair of hairs, the petiole one pair and the postpetiole two hairs. the gaster has 12-16 suberect hairs on the first tergite. The head and alitrunk have shallow reticulopunctate sculpture becoming thinner on the nodes and gaster which are shining.

Affinities: This species is very similar to *M. wahibiense* n. sp. but is differentiated by the projecting occipital hairs and the long ventral head hairs.

Monomorium venustum (Smith, 1858) (Fig. 30)

Myrmica venusta Smith, 1858. — Cat. Hym. Brit. Mus. 6: 127.

Monomorium venustum. — Roger 1863; Berl. ent. Z. 7: 32.

Material: Saudi Arabia: 1 ♀, ♀♀, Wadi Arsida, 10.IX.1982, W. Büttiker. — Kuwait: 1 ♀, ♀♀, Jal al-Zour, 6.III.1988, W. Büttiker. — Oman: ♀♀ from: Montasar, 14.IX.1982; Jabal Qara, 26.IX.1982; Rumais, 2.X.1983; all M.D. Gallagher.

Measurements: HL 0.85-1.10; HW 0.70-0.88; SL 0.75-0.95; EL/HW 0.28-0.33; CI 79-86; SI 106-118.

This evenly red species has somewhat variable sculpture with a reticulostriate head, reticulate alitrunk and nodes and more superficially reticulate gaster. The general appearance is smoother and more brightly coloured than *M. areniphilum*. The petiole is rounded in dorsal view and never wider than long. The intermediate funiculus segments are all slightly longer than wide. There are no subcephalic hairs or suberect dorsal pubescence. The petiole and postpetiole each have one pair of dorsal hairs and the first gastral tergite is bare. It is abundant in the countries of the Middle East but gives way to the many similar species to be found in Arabia.

Monomorium wahibiense n. sp. (Fig. 31)

Holotype: ♀, Oman, Wahiba Sands, 6.VIII.1986, M.D. Gallagher. — **Paratypes:** Oman: ♀♀, same series as holotype. — United Arab Emirates: ♀♀, Djebel Haffete, 3-4.X.1984, H. Heatwole; ♀♀, Ras Ghanada, IX.1992, B. Tigar.

Measurements of holotype: TL 2.65; HL 0.66; HW 0.51; EL/HW 0.307; range: CI 78-86; SI 102-9.

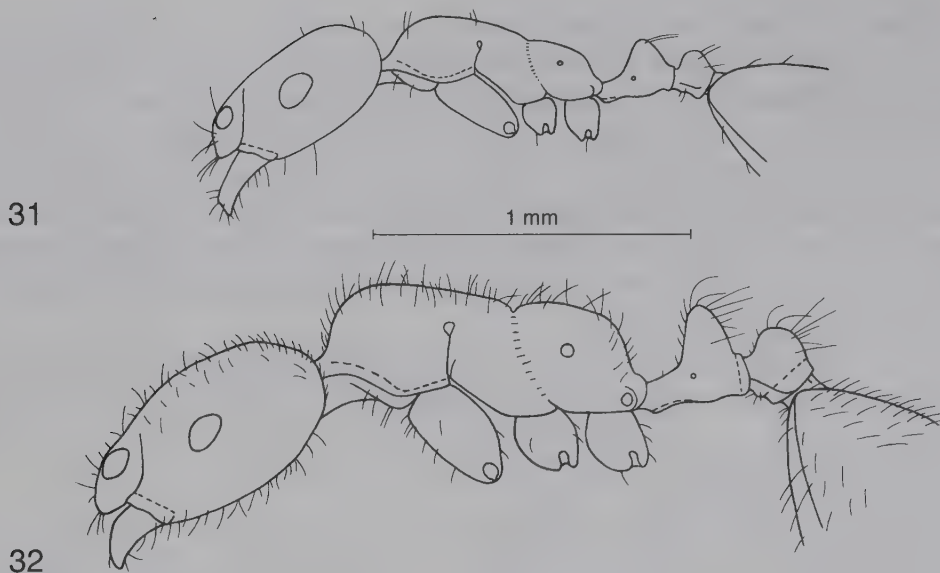
Description: The clypeal front border is straight. The head has curved sides broadening anteriorly from eye level. The alitrunk is low and flat with a shallow mesopropodeal break and the propodeal furrow is shallow without raised side margins. The alitrunk has one pair of hairs, the petiole one pair and the postpetiole two pairs. The gaster and ventral head have several hairs. The head has reticulopunctate sculpture, the alitrunk is weakly sculptured except at the sides of the mesopropodeum. The gaster is brilliant and the general aspect shining.

Affinities: *M. wahibiense* is very similar to *M. mintiribe* n. sp. but can be immediately distinguished by the less steep-sided lower petiole node. HEATWOLE (1990) found *Monomorium* ants to be the commonest component of the desert ant fauna in the United Arab Emirates sand dunes. *M. wahibiense* was the most numerous and is clearly a true desert-adapted species.

Monomorium yemene n. sp. (Fig. 32)

Holotype: ♀, Yemen, Taiz, 20.X.1991, A. van Harten. — **Paratypes:** Yemen: ♀♀, same series as holotype; ♀♀, Zingibar-Shugra, 21.III.1993, C.A. Collingwood.

Measurements of holotype: TL 3.4; HL 0.87; HW 0.72; SL 0.77; CI 62.7; SI 106.9.



Figs 31-32: Head and alitrunk in profile: 31, *Monomorium wahibiense* n. sp., ♀; 32, *M. yemene* n. sp., ♀.

Description: The head is broadly rounded with the occiput emarginate. The clypeus is emarginate. The mesopropodeal furrow is deeply impressed and the propodeal dorsum rounds steeply into its declivous face. The petiole is relatively wide in dorsal view, more than a quarter times HW. Sculpture and colour are as in *M. fayfaense* n. sp.. The whole dorsum including head, alitrunk, nodes and gaster is covered with abundant pale hairs. BOLTON (1987) noted this species without naming it as being similar to *M. hirsutum* Forel, 1910 from Ethiopia but pointed out differences in the shape of the alitrunk and the presence of abundant erect pubescent hairs on all appendage surfaces including the antennae. The eyes are small, 0.19-0.20 times HW as in *M. hirsutum*, but the unusual long erect pubescence distinguishes *M. yemene* from all other species within this complex.

Genus *Solenopsis* Westwood, 1840

Key to species

- 1 Postpetiole with an anteroventral flange which appears as a tooth-like projection in profile. Body hairs numerous, on the head fringing round the occiput and genae
Solenopsis omana n. sp.
- Postpetiole without a distinct anteroventral projection when seen in profile. Body hairs sparse, not making a continuous fringe round the head 2
- 2 Dorsal face of propodeum longer than descending face; head rectangular in dorsal view; CI 72
Solenopsis sumara n. sp.
- Dorsal face of propodeum about as long as or shorter than descending face; head more square, CI 78
Solenopsis zingibara n. sp.

Solenopsis omana n. sp. (Fig. 33)

Holotype: ♀, Oman, Ruwi, 15.II.1985, R. Braund. — Paratypes: Oman: 5 ♀♀, same series as holotype. — United Arab Emirates: 1 ♀, Suneira, 25°12'N 55°33'E, 15.IV.1991, J. Gosse.

Measurements of holotype: TL 2.0; HL 0.57; HW 0.44; SL 0.36.

Description: Eye with seven ommatidia. The centre clypeal teeth are widely spaced, short and blunt. The teeth at each side appear as very small projections. The mesopropodeal furrow is deep making an acute angle in profile. The postpetiole has an anteroventral flange or ridge that appears as a small projecting tooth in profile. The head is subrectangular in dorsal view, the CI ranging from 78.9 to 80.5. The head in profile appears narrow with a flat ventral surface. The head has scattered large punctures and the rest of the body has little or no sculpture. All surfaces are covered with long hairs which appear as a fringe surrounding the occiput and genae.

Affinities: This species differs from *S. orbula* Emery, 1875 of North Africa, Malta and Italy by the much shorter head and more abundant longer pilosity but shares with that species and another Middle Eastern species the projecting ventral flange which appears as distinct tooth on the postpetiole.

Solenopsis sumara n. sp.

Holotype: ♀, Yemen, Sumara Pass, 2500 m, 7.III.1993, C.A. Collingwood. — **Paratypes:** ♀♀, same series as holotype.

Measurements: TL 1.5-1.75; HL 0.55-0.68; HW 0.46-0.51; SL 0.36-0.43.

Description: Head subrectangular with incavate occiput, SI 78. Central clypeal teeth prominent, incurved and narrowly set, lateral teeth hardly visible in dorsal view. Head sculpture with wide-spaced punctures only and general aspect brilliant. Eyes very small with 2-3 ommatidia. The mesopropodeal furrow is a deep narrow cleft but the propodeum continues the line of the promesonotum and forms a gradual flat slope which is slightly longer than its descending face. The antennae and legs have long suberect pubescence, the scape hairs being slightly longer than the maximum scape width. The alitrunk and gaster have occasional long hairs and the head hairs are numerous but short. The ants were in small crowded nests under stones.

Solenopsis zingibara n. sp.

Holotype: ♀, Yemen, Wadi near Zingibar, 21.III.1993, C.A. Collingwood. — **Paratypes:** 7 ♀♀, same series as holotype.

Measurements: TL 1.6-2.8; HL 0.50-0.70; HW 0.40-0.61; SL 0.35-0.40.

Description: Head rather square, only slightly longer than wide with gently curved sides and weakly concave occiput. The eyes are small with only 3-4 ommatidia. Central clypeal teeth prominent, lateral teeth slightly projecting and visible in dorsal view. In the larger workers the head has six strong frontal striae and scattered coarse punctures. The alitrunk and nodes have spaced punctulate sculpture. The anterior edge of the propodeum is slightly raised at the well-marked mesopropodeal furrow. The propodeal dorsum is shorter than its descending face and obliquely rounded. The body and head pilosity is sparse. The colour is yellowish brown and the general aspect shining. Workers were taken singly in a lowland valley.

Subfamily Dolichoderinae

Key to genera

- 1 In dorsal view four gastral tergites visible; anal orifices situated ventrally *Tapinoma*
- In dorsal view five gastral tergites visible; anal orifices situated apically *Technomyrmex*

Genus *Tapinoma* Foerster, 1850

Key to species

- | | | | |
|---|--------------------------------------------------------------------------------------|--------------------------------|---|
| 1 | Size very small, TL less than 2.0; front of head with dark areas, rest of body pale | <i>Tapinoma melanocephalum</i> | |
| – | Larger species, TL more than 2.5; head and rest of body uniformly coloured | | 2 |
| 2 | Central clypeal notch shallow, clearly wider than deep | <i>Tapinoma</i> sp. | |
| – | Central clypeal notch well defined, clearly deeper than wide | <i>Tapinoma simrothi</i> | |

Tapinoma melanocephalum (Fabricius, 1793)

Formica melanocephala Fabricius, 1793. — Ent. Syst. 2: 353.

Tapinoma melanocephalum. — Mayr 1862; Verh. zool.-bot. Ges. Wien 12: 651.

Material: Yemen: ♀♀, Aden Chalet, 12.XI.1988, H. Wranik.

Tapinoma simrothi Krausse, 1911

Tapinoma simrothi Krausse, 1911. — Boll. Soc. ent. Ital. 41: 18.

Material: Kuwait: ♀♀, Failaka Island, 31.III.1988, W. Büttiker; ♀♀, Wadi Umm al-Rumam, 21.II.1989, M.D. Gallagher. — Yemen: ♀♀, Al-Mahwit, 9.III.1993, C.A. Collingwood.

This common Mediterranean and Middle Eastern species occurred in the garden of a hostel at Al-Mahwit and had invaded the kitchen.

Tapinoma sp.

Material: Yemen: ♀♀, Suq Bani Mansur, 27.IV.1991, A. van Harten.

Measurements: TL 3.20; HL 0.91; HW 0.87; SL 0.91; SI 104.5.

This species has the low profile, colour, general appearance and size of *T. simrothi* but the central clypeal notch is shallow.

Genus *Technomyrmex* Mayr, 1872

Key to species

- | | | | |
|---|---------------------------------------------------------------------------------------------------------------|-------------------------------|---|
| 1 | Body colour yellowish brown or bicoloured | | 2 |
| – | Body colour evenly greyish or black | | 4 |
| 2 | Bicoloured ants; TL 2.7-2.9; dorsum with scattered suberect hairs | <i>Technomyrmex setosus</i> | |
| – | Pale yellowish-brown ants; TL 2.50 or less; dorsum of alitrunk bare | | 3 |
| 3 | Front tibiae and femora enlarged; smaller species, TL 1.75; antennal scapes do not reach the occipital margin | <i>Technomyrmex</i> sp. A | |
| – | Front tibiae not enlarged; TL 2.2-2.5; antennal scapes long, over-reaching the occipital margin, SI 125 | <i>Technomyrmex</i> sp. B | |
| 4 | Legs and antennae entirely pale grey, body colour dark grey | <i>Technomyrmex bruneipes</i> | |
| – | Legs, antennae and body dark brownish black except for tarsi and funiculi which are pale | <i>Technomyrmex albipes</i> | |

Technomyrmex bruneipes Forel, 1895 n. stat.

Technomyrmex albipes var. *bruneipes* Forel, 1895. — J. Bombay Nat. Hist. Soc. 9: 466.

Material: Yemen: ♀♀ from: Sana'a, II.1991; Al-Mahwit, 7.VI.1991; Hammam Ali, 5.VIII.1991; Al-Hajjarah, 14.III.1992; all A. van Harten.

Measurements: TL 2.5-2.8; HL 0.56-0.59; SL 0.52-0.53; EL 0.19.

The legs and antennae are entirely pale grey contrasting with the dark brown body. The head and alitrunk are coarsely reticulopunctate, the gaster moderately shining. This appears to be quite a common species in Yemen. *T. bruneipes* was described and recorded from India and possibly occurs in Africa and could well be a successful tramp species like the similar *T. albipes* Smith, 1861.

Technomyrmex setosus Collingwood, 1985

Technomyrmex setosus Collingwood, 1985. — Fauna of Saudi Arabia 7: 243.

Material: Saudi Arabia: ♀♀ from: Jebel Beles, 1.IX.1984; Al-Farah, 9.VIII.1983; Harithi, 11.IV.1984; all W. Büttiker. — Yemen: ♀♀, Al-Hajjarah, 14.III.1992, A. van Harten.

Technomyrmex sp. B (in COLLINGWOOD 1985)

Material: Oman: ♀♀ from: Bani Sur, 7.III.1984; Eastern Sands, III.1986; all W. Büttiker. — Yemen: ♀♀, near Mafhaq, 14.III.1992, A. van Harten.

Measurements: TL 2.2-2.4; HL 0.54-0.65; HW 0.52-0.56; SL 0.62-0.70; EL 0.18-0.19; SI 119-125.

This species as described in COLLINGWOOD (1985) has exceptionally long antennae and large eyes.

Subfamily Formicinae

Key to genera

- | | | |
|---|-------------------------------------------------------------------------------------------------------------------------|---------------------|
| 1 | Antennae with 12 segments | 2 |
| — | Antennae with 11 segments | 5 |
| 2 | Antennal insertions distant from clypeal margin | 3 |
| — | Antennal insertions close to or contiguous with clypeal margin | 4 |
| 3 | Petiole with spines or teeth; pronotum bidentate | <i>Polyrhachis</i> |
| — | Petiole entire or emarginate, never dentate; pronotum without projecting teeth | <i>Camponotus</i> |
| 4 | Ocelli present and distinct; head with long curved hairs on anteroventral surface; dorsum of propodeum with erect hairs | <i>Cataglyphis</i> |
| — | Ocelli vestigial or absent; ventral head with short hairs only; dorsum of propodeum without erect hairs | <i>Paratrechina</i> |
| 5 | Propodeum bituberculate or bidentate; petiole emarginate and usually bidentate | <i>Lepisiota</i> |
| — | Propodeum unarmed; petiole never emarginate | 6 |
| 6 | In dorsal view metanotum separated from mesonotum by impressed suture | <i>Plagiolepis</i> |
| — | Metanotum not distinguished by sutures; mesopropodeal furrow rounded and shallow | <i>Anoplolepis</i> |

Genus *Plagiolepis* Mayr, 1861

Key to species

- | | | |
|---|-----------------------------------------------------------------------------------------------------|-------------------------------|
| 1 | Size very small, TL less than 1.3; yellow to yellowish-brown ants | 2 |
| – | Size larger, TL 1.5-2.2; body colour pale brown to dark brown | 3 |
| 2 | Yellowish-brown ants | <i>Plagiolepis abyssinica</i> |
| – | Bright yellow ants | <i>Plagiolepis exigua</i> |
| 3 | Second and third funiculus segments subequal, broader than long, each much shorter than the fourth | <i>Plagiolepis pygmaea</i> |
| – | Third funiculus segment longer than second. | 4 |
| 4 | Third and fourth funiculus segments subequal, longer than broad; pubescence on appendages prominent | <i>Plagiolepis schmitzii</i> |
| – | Third funiculus segment quadrate, slightly shorter than fourth; pubescence sparse | <i>Plagiolepis maura</i> |

Plagiolepis exigua Forel, 1894

Plagiolepis exigua Forel, 1894. — J. Bombay Nat. Hist. Soc. 8: 415.

Material: Yemen: ♀♀ from: Taiz, 20.X.1991; Aden, 18.XII.1991; all A. van Harten; ♀♀ from: near Al-Mahwit, 10.III.1993; Taiz – Al-Turbah, 14.III.1993; all C.A. Collingwood.

This very small yellow ant was taken by sweeping and from the ground. The very slightly larger darker ant recorded as *P. abyssinica* in COLLINGWOOD (1985) was taken in rotten wood. *P. exigua* is almost a cosmopolitan species frequently being found in hot houses in Europe.

Plagiolepis maura Santschi, 1920

Plagiolepis maura Santschi, 1920. — Bull. Soc. Vaud. Sci. nat. 53: 169.

Material: Oman: ♀♀, Ain Hamran, Dhofar, 15.XII.1984, M.D. Gallagher. — Yemen: ♀♀ from: Sana'a, IX.1991; Al-Mahwit, 16.III.1992; Al-Tawilan – Al-Mahwit, 16.III.1992; all A. van Harten; ♀♀, Al-Kowd, II.1993, M. Knapp.

Genus *Anoplolepis* Santschi, 1914

Key to species

- | | | |
|---|-------------------------------------------------------------------|---------------------------------------|
| 1 | Minute brown ants, TL 1.4 | <i>Anoplolepis tumidula</i> |
| – | Larger darker ants, TL 2.3-2.5 with exceptionally long pale tarsi | <i>Anoplolepis longitarsis</i> n. sp. |

Anoplolepis longitarsis n. sp.

Holotype: ♀, Suq al-Ahad, 26.III.1983, C.A. Collingwood. — Paratypes: Yemen: ♀♀ from: Bajil-Zabid, 15.III.1993; Bajil-Khamis Bani Sad, 16.III.1993; A. van Harten, C.A. Collingwood.

Measurements of holotype: TL 2.35; HL 0.65; HW 0.55; SL 0.60; EL 0.23; hind femur 0.85; hind tibia 0.86; hind tarsus 1.00.

Description: Antennae with 11 segments, the first funiculus segment nearly equal to the second plus third. All funiculus segments elongate. The laid back scape over-reaches the occipital margin by about the length of the first funiculus segment. The hind tarsi are long, the segments together being longer than either the tibia or the femur. The propodeal spiracle is large and

prominent. The petiole is an upright scale. The alitrunk dorsal profile is flat with the outline interrupted by the shallow mesopropodeal furrow. The maxillary palps are longer than the head. The body colour is uniformly brown with the legs becoming paler towards the tibiae and tarsi, the latter being yellowish. The body, legs and antennae are clothed with short adpressed pubescence. Several workers were taken by sweeping low herbage in Yemen but always singly and not in groups. Workers were often seen on the foliage of Leguminosae. Nests were not found.

Affinities: This genus includes several African species but the large eyes and exceptionally long tarsi seem to be unique to this small, narrow-bodied species.

Anoplolepis tumidula (Emery, 1915)

Plagiolepis (*Anoplolepis*) *tumidula* Emery, 1915. — Boll. Lab. Zool. gen. agr. R. Scuola sup. Agric., Portici 10: 19.

Anoplolepis (*Tapinolepis*) *tumidula*. — Emery 1925; Gen. Ins. 183: 18.

Genus *Lepisiota* Santschi, 1926

This genus has been known as *Acantholepis* Mayr, 1861 for about 130 years but this name is a junior homonym of *Acantholepis* Kraye, 1846. *Lepisiota* Santschi, 1926 is the first available replacement name (BOLTON 1994). The new combination was then designated by Bolton one year later in the new catalogue of the ants of the world (BOLTON 1995: 226-229).

Key to species

- | | | |
|---|----------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|
| 1 | Antennal scape long, over-reaching the occipital margin by half its length or more; SI 150-205 | 2 |
| — | Antennal scape shorter, over-reaching the occipital margin by a third of its length or less; SI 105-138 | 16 |
| 2 | Dorsum of alitrunk and gaster without any standing hairs; antennal scapes excep- tionally long; SI 200-205 | <i>Lepisiota riyadha</i> n. sp. |
| — | Dorsum of alitrunk with at least one or two pairs of long hairs on the pronotum; gaster always with some projecting hairs; SI 200 or less | 3 |
| 3 | Bicoloured ants; alitrunk paler than gaster, mainly or entirely reddish | 4 |
| — | Whole body dark except a small area of the mesonotum more or less reddish in a few species | 9 |
| 4 | Alitrunk with whole dorsum clothed with blunt black hairs | <i>Lepisiota arabica</i> |
| — | Alitrunk with one, two or three pairs of fine hairs on the pronotum | 5 |
| 5 | Body sculpture coarse, general appearance opaque | 6 |
| — | All parts of the body shining with superficial reticulate sculpture at most | 7 |
| 6 | Petiole wide, at least 0.33 times HW; head densely sculptured and dull | <i>Lepisiota sericea</i> |
| — | Petiole narrower, less than 0.30 times HW; vertex of head moderately shining | <i>Lepisiota bipartita</i> |
| 7 | Head and alitrunk clear red; propodeum armed with long curved spines | <i>Lepisiota arenaria</i> |
| — | Head darker than alitrunk; propodeum simply dentate or armed with short straight spines | 8 |

- 8 Legs and antennae clear yellow; propodeal and petiole spines sharp
Lepisiota dammama n. sp.
- Legs and antennae dark; propodeum bluntly dentate *Lepisiota dolabellae*
- 9 Alitrunk sculptured without lustre 10
- Alitrunk with or without sculpture but always at least moderately shining, in some species brilliant 11
- 10 Head and alitrunk densely sculptured and completely opaque; propodeal spines long and curved *Lepisiota dhofara* n. sp.
- Head and alitrunk sculptured but details of sculpture easily seen at low magnification and head with some shine; propodeal armature short and blunt
Lepisiota karawajewi
- 11 Whole body entirely black, brilliant or with slight reticulate sculpture at most 12
- Alitrunk often or usually with small area of mesonotum reddish; head and alitrunk distinctly sculptured, shining but not brilliant 15
- 12 Propodeal and petiole armature both well developed with long curved spines; antennal scapes long, SI 165-200 13
- Propodeal spines short and straight, petiole dorsum narrow and rounded with reduced armature; antennal scapes shorter, SI 150-155 *Lepisiota nigra*
- 13 Propodeum and first gastral tergite with some fine surface sculpture; SI 195-200
Lepisiota opaciventris
- Whole body brilliant; SI 165-195 14
- 14 Propodeal spines excessively developed, more than 0.12 mm long and distinctly curved; SI 165-170 *Lepisiota spinisquama*
- Propodeal spines shorter, less than 0.10 mm long, moderately curved; SI 175-195
Lepisiota gracilicornis
- 15 Petiole distinctly dentate *Lepisiota frauenfeldi*
- Petiole dorsum feebly incavate or narrowly rounded without teeth
Lepisiota nigrescens
- 16 Head and gaster smooth and shining with faint sculpture at most. 17
- Head and gaster distinctly sculptured 19
- 17 Whole body dorsum covered with blunt black hairs *Lepisiota validiuscula*
- Alitrunk with pale thin hairs 18
- 18 Alitrunk hairs restricted to pronotum *Lepisiota simplex*
- Whole alitrunk dorsum covered with long pale hairs *Lepisiota canescens*
- 19 Whole alitrunk dorsum covered with long pale hairs *Lepisiota obtusa*
- Hairs on alitrunk dorsum restricted to pronotum or none 20
- 20 Petiole angles produced into long spines 21
- Petiole dorsum flat, emarginate or dentate at most 22
- 21 Petiole spines longer than their intervening width *Lepisiota incisa*
- Petiole spines shorter than their intervening width *Lepisiota carbonaria*
- 22 Petiole dentate; coarse dorsal sculpture not obscuring cuticular shine
Lepisiota depilis
- Petiole with shallow emargination or with dorsum flat or simply rounded; whole body dull without shine 23
- 23 Alitrunk red, contrasting with dense black gaster; propodeum dentate; pronotum with one or two pairs of hairs
Lepisiota harteni n. sp.

- Whole body dark; propodeum with blunt projections only, not dentate; alitrunk entirely without dorsal hairs
Lepisiota erythraea

Lepisiota arenaria (Arnold, 1920)

Acantholepis arenaria Arnold, 1920. — Ann. S. Afr. Mus. 14: 560.

Material: Oman: ♀♀ from: Jabal Qarn, 27.IX.1984; Wadi Rawnab, 1.X.1984; all M.D. Gallagher.

Measurements: HW 0.68-0.69; SI 167-176.

This elegant red species was misidentified as *Acantholepis longinoda* Arnold, 1920 from Wahiba Sands in COLLINGWOOD (1985). The two species have similar morphological characteristics but *L. longinoda* is more sculptured.

Lepisiota bipartita (F. Smith, 1861)

Formica bipartita F. Smith, 1861. — J. Proc. Linn. Soc. Lond. 6: 33.

Acantholepis bipartita. — Roger 1863; Verz. Formicid.: 11.

Material: Saudi Arabia: ♀♀, Jeddah, 2.VI.1977, W. Büttiker.

Measurements: HW 0.55-0.65; SI 163-180.

This bicoloured species is common in the Middle Eastern countries.

Lepisiota canescens (Emery, 1897)

Acantholepis capensis canescens Emery, 1897. — Ann. Mus. civ. Stor. nat. Giacomo Doria 38: 601.

Acantholepis canescens. — Bernard & Cagniant 1962; Bull. Soc. ent. Fr. 67: 163.

Material: Oman: ♀♀ from: Jabal Samhan, Muscat, 25.IV.1984; Dhe Ayrib 25.IV.1984; all J. Darlington. — Yemen: ♀♀, Hammam Ali, 5.VIII.1991, A. van Harten.

Measurements: HW 0.60-0.61; SI 108-121.

Lepisiota carbonaria (Emery, 1892)

Acantholepis carbonaria Emery, 1892. — Ann. Mus. civ. Stor. nat. Giacomo Doria 32: 119.

Material: Oman: ♀♀, Wadi Shuwayiyah, 27.XII.1982, M.D. Gallagher. — Yemen: ♀♀ from: Rissabah, 8.X.1991; Taiz, 20.X.1991; beach E of Aden, 18.XII.1991; all A. van Harten; ♀♀, Ma'agala, 22.II.1992, M. Mahyoub; ♀♀, Aden Chalet, 10.X.1988, H. Wranik; ♀♀, Madinat al-Shariq, 7.III.1993, C.A. Collingwood.

Measurements: HW 0.60-0.61, SI 116.

Lepisiota dammama n. sp.

Holotype: ♀, Saudi Arabia, Dammam, 26°24'N 50°11'E, 5.I.1979, W. Büttiker. — Paratypes: Saudi Arabia: ♀♀, same series as holotype; ♀♀ from: Jebel Maniq, 5.I.1979; Wadi Awsat, 31.XII.1976; all W. Büttiker.

Measurements of holotype: HW 0.61; SL 0.95; EL 0.23; SI 153; EL/HW 0.37.

Description: This is a large-eyed, shining bicoloured species with sharp pointed propodeal and petiole spines, pale antennae and legs. The head is brilliant black, the gaster brownish and the alitrunk confusedly coloured with pale red and dark areas.

Affinities: It is distinguished from *L. frauenfeldi* by the sharper spines, more shining appearance and much paler colour.

Lepisiota depilis (Emery, 1897)

Acantholepis capensis depilis Emery, 1897. — Ann. Mus. civ. Stor. nat. Giacomo Doria 38: 602.

Acantholepis depilis. — Collingwood 1985; Fauna of Saudi Arabia 7: 294.

Material: Oman: ♀♀, Marhbat, 19.IX.1984, M.D. Gallagher.

Measurements: HW 0.62; SI 112-113.

Lepisiota dhofara n. sp.

Holotype: ♀, Oman, Jabal Qara, 18.X.1984, J. Darlington.

Measurements of holotype: HW 0.60; SL 1.05; SI 175.

Description: This is a very densely sculptured opaque species entirely without surface shine on the head or alitrunk. The propodeal spines are long and curved but the petiole teeth are shorter than their intervening space. The dull appearance is due to the close microsculpture, not to pubescence which is sparse.

Lepisiota erythraea (Forel, 1910)

Acantholepis carbonaria var. *erythraea* Forel, 1910. — Zool. Jb. Abt. Syst. 29: 265.

Acantholepis erythraea. — Collingwood 1985; Fauna of Saudi Arabia 7: 294.

Material: Yemen: ♀♀, Sana'a, VII.1992, A. van Harten; ♀♀, Taiz – Mafhaq, 15.III.1993, C.A. Collingwood.

Measurements: HW 0.57-0.58, SI 107.

Lepisiota gracilicornis (Forel, 1892)

Acantholepis gracilicornis Forel, 1892. — Ann. Soc. ent. Belg. 36: 42.

Material: Oman: ♀♀ from: Wadi Himna, 14.II.1984; Wadi Sayq, 12.III.1985; Mintirib, XII.1985; Al-Khuwaymah, 19.VII.1986; all M.D. Gallagher; ♀♀, Khasab, Musandham, 15.I.1984, R. Braund. — Yemen: ♀♀ from: Sana'a, V.1991; Hammam Ali, 5.VIII.1991; all A. van Harten; ♀♀ from: Wadi Wazan, 14.III.1993; Wadi Bani, 20.III.1993; all C.A. Collingwood.

Measurements: HW 0.64-0.65; SI 178-183.

Lepisiota harteni n. sp. (Fig. 34)

Holotype: ♀, Yemen, Hammam Ali, 16.II.1992, A. van Harten. — Paratypes: 9 ♀♀, same series as holotype.

Measurements of holotype: TL 2.80; HL 0.61; HW 0.57; SL 0.70; EL 0.17.

Description: This is a rather small, sculptured species with a reddish alitrunk. The whole body including the gaster has close punctulate sculpture. The propodeal spines are short and broad-based. The petiole is truncate without lateral teeth and a very shallow emargination. The gaster has relatively dense decumbent pubescence. There is no raised pubescence on the legs or antennae. There is one pair of hairs on the pronotum. The head is fringed with short suberect pubescence.

Affinities: This species corresponds with *L. frauenfeldi* var. *truncata* (Santschi, 1927) but according to Santschi (loc. cit.) *L. f.* var. *truncata* is a small version of *L. velox* (Baroni Urbani, 1968), a moderately shining species whereas *L. harteni* is entirely dull with a much more pubescent gaster.

Lepisiota incisa (Forel, 1913)

Acantholepis capensis r. *incisa* Forel, 1913. — Rev. Zool. Afr. 2: 338.

Acantholepis incisa. — Collingwood 1985; Fauna of Saudi Arabia 7: 295.

Material: Yemen: ♀♀ from: Al-Mahwit, 29.IV.1991; Wadi Surdud, 27.XII.1991; all A. van Harten; ♀♀, Aden Chalet, 18.X.1988, H. Wraniik; ♀♀, Madinat al-Shariq, 7.III.1993, C.A. Collingwood.

Measurements: HW 0.56-0.57; SI 105-107.

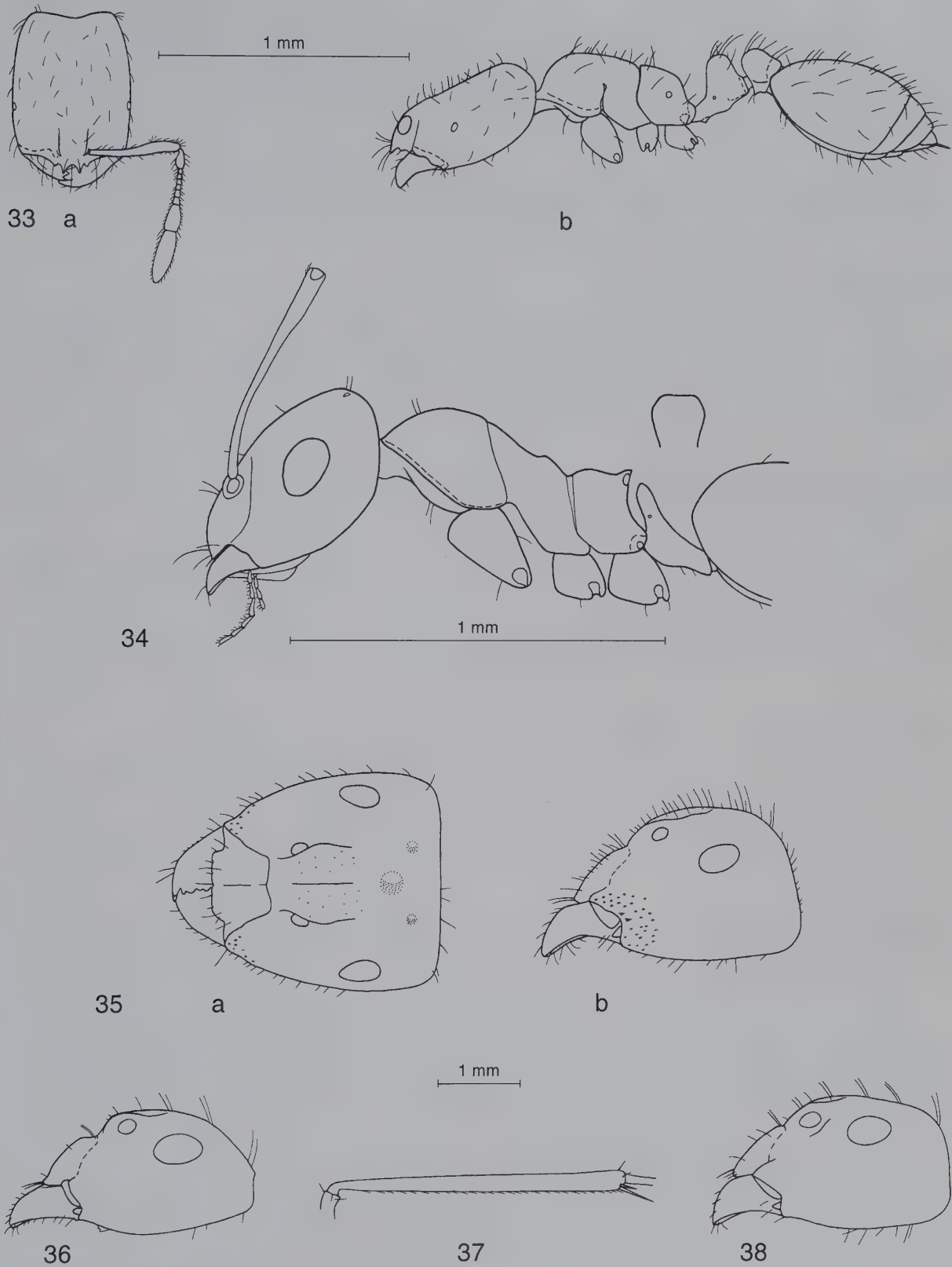
Lepisiota karawajewi (Agosti & Collingwood, 1987)

Acantholepis karawajewi Agosti & Collingwood, 1987. — Mitt. Schweiz. ent. Ges. 60: 57.

Material: Kuwait: ♀♀, Jebel an-Nir, 5.II.1988, W. Büttiker.

Measurements: HW 0.56-0.65; SI 152-166.

This is a dull-sculptured species, common in the southern Greek Islands.



Figs 33-38: 33, *Solenopsis omana* n. sp., ♀: a, head and alitrunk in profile; b, head in dorsal view; 34, *Lepisiota harteni* n. sp., ♀, head and alitrunk in profile; 35, *Camponotus carbo*, ♀: a, head in dorsal view; b, head in profile; 36, *C. fellah*, ♀, head in profile; 37, *C. gallagheri* n. sp., ♀, hind femur and tibia; 38, *C. somalinus*, ♀, head in profile.

***Lepisiota nigra* (Dalla Torre, 1893)**

Acantholepis frauenfeldi var. *nigra* Dalla Torre, 1893. — Cat. Hym. 7: 171.

Acantholepis frauenfeldi var. *nigra* Emery, 1893. — Boll. Soc. ent. Ital. 47: 221.

Acantholepis nigra Emery. — Agosti & Collingwood 1987; Mitt. Schweiz. ent. Ges. 60: 57.

Material: Oman: ♀♀, Qurm Creek, 6.XI.1987, M.D. Gallagher.

Measurements: HW 0.63-0.64, SI 150-165.

This is a black shining ant, similar to *L. gracilicornis* in body shine but morphologically closer to *L. frauenfeldi*. It is a local south east European species.

***Lepisiota nigrescens* (Karawaiew, 1912)**

Acantholepis frauenfeldi var. *nigrescens* Karawaiew, 1912. — Russk. ent. Obozr. 12 15.

Acantholepis nigrescens. — Collingwood 1985; Fauna of Saudi Arabia 7: 295.

Material: Saudi Arabia: ♀♀, Wadi Mizbil, 14.IV.1977, W. Büttiker. — United Arab Emirates: ♀♀, Ras Ghanada, IX.1992, B. Tigar. — Yemen: ♀♀, Sumara Pass, 13.III.1993, C.A. Collingwood.

Measurements: HW 0.62; SI 166-167.

***Lepisiota obtusa* (Emery, 1901)**

Acantholepis carbonaria var. *obtusa* Emery, 1901. — Boll. Soc. ent. Ital. 33: 63.

Acantholepis obtusa. — Collingwood 1985; Fauna of Saudi Arabia 7: 296.

Material: Oman: ♀♀ from: Wadi Khawr, 18.I.1983; Wadi Halq, 26.IX.1984; all M.D. Gallagher. — Yemen: ♀♀, Sadah, 13.VIII.1991, A. van Harten; ♀♀ from: Qa al-Boun, X.1991; Shabwah, 21.III.1992; Jeyun, 30.III.1992; all M. Knapp; ♀♀, Al-Mahwit, 10.III.1993, C.A. Collingwood.

Measurements: HW 0.61-0.62; SI 116-118.

***Lepisiota opaciventris* (Finzi, 1936)**

Acantholepis frauenfeldi var. *opaciventris* Finzi, 1936. — Sber. Akad. Wiss. Wien math.-naturw. Kl. 139: 23.

Acantholepis opaciventris. — Collingwood 1985; Fauna of Saudi Arabia 7: 295.

Material: Yemen: ♀♀ from: Al-Mahwit, 7.VI.1991; Wadi Surdud, 29.XII.1991; Hammam Ali, 16.II.1992; Madinat al-Shariq, 12.III.1992; all A. van Harten; ♀♀, Bajil Zabid, 15.III.1993, C.A. Collingwood.

Measurements: HW 0.60-0.70; SI 197-200.

***Lepisiota riyadha* n. sp.**

Holotype: ♀, Saudi Arabia, Riyadh Agricultural Station, 27.III.1983, C.A. Collingwood. — Paratypes: 5 ♀♀, same series as holotype.

Measurements of holotype: HW 0.50; SL 1.01; range: HW 0.47-0.63; SL 1.00-1.25.

Description: The colour and body size is as in *L. frauenfeldi* (Mayr, 1855) but the antennal scapes are much longer, SI 199-205. There are no erect hairs on the alitrunk. The petiole spines are well developed but not so long relatively as in *L. gracilicornis* and *L. opaciventris*, the other long-scaped species.

***Lepisiota sericea* (Forel, 1892)**

Acantholepis frauenfeldi var. *sericea* Forel, 1892. — Ann. Soc. ent. Belg. 36: 41.

Lepisiota sericea. — Pisarski 1967; Ann. Zool. 24: 408.

Material: Oman: 1 ♀, Rumais, Muscat, 24.XI.1983, M.D. Gallagher; 1 ♀, Wattayah, 22.XI.1983, W. Büttiker.

Measurements: HW 0.63; SI 158.

This is a dull sculptured species also characterised by its wide simply-angled petiole about 0.3 times HW. The alitrunk is reddish. It is recorded from the Indian subcontinent.

Lepisiota spinisquama (Kuznetsov-Ugamsky, 1929)

Acantholepis frauenfeldi var. *spinisquama* Kuznetsov-Ugamsky, 1929. — Zool. Anz. 82: 480.

Acantholepis spinisquama. — Pisarski 1967; Ann. zool. Warsz. 24 (6): 410.

Material: Oman: ♀♀ from: Madinat Qaboos, 5.XI.1983; Jabal Akhdar, 24.II.1984; Qarn al-Alam, 14.V.1984; Rima Oil Camp, IX.1984; Khawr Niad, 25.X.1984; all M.D. Gallagher. — Socotra: ♀♀, Hadibo, Muomi, Nogeed, Mouri, 14-17.IV.1993, A. van Harten.

Measurements: HW 0.65-0.71; SI 169-171.

This species has exceptionally long curved spines and is apparently common on the island of Socotra. Elsewhere it is recorded from Turkestan and Afghanistan and is also evidently well established in parts of Oman.

Lepisiota validiuscula (Emery, 1897)

Acantholepis capensis var. *validiuscula* Emery, 1897. — Ann. Mus. civ. Stor. nat. Genova 18: 602.

Material: Yemen: ♀♀ from: Sana'a, many collections I.1991-X.1991; Al-Mahwit, 21.IX.1981; Amran, 11.II.1992; Hammam Ali, 16.II.1992; all A. van Harten.

Measurements: HW 0.59-0.63; SI 125-135.

This seems to be a very abundant species in western Yemen, easily distinguished from *L. canescens* by the stout black dorsal hairs. It is recorded from East and South Africa but has not yet been found in Arabia outside Yemen.

Lepisiota sp.

Material: Oman: 1 ♀, Mintirib, 8.II.1986, W. Büttiker.

This has the pale brownish-yellow colour of *L. fergusonii* (Forel, 1895) from India but the only available specimen is too damaged for a formal description or identification.

Genus *Paratrechina* Motschulsky, 1863

Key to species

- | | | | |
|---|------------------------------------------------------------------------------------------------------------|------------------------------------|---|
| 1 | Antennal scapes very long, extending as far as the mesonotum; the scapes and tibiae have no suberect hairs | <i>Paratrechina longicornis</i> | |
| — | Antennal scapes and legs shorter, always with some suberect hairs. | | 2 |
| 2 | Gaster covered with thick pubescence | <i>Paratrechina jaegerskioeldi</i> | |
| — | Body pubescence sparse | <i>Paratrechina flavipes</i> | |

Paratrechina flavipes (Smith, 1874)

Tapinoma flavipes Smith, 1874. — Trans. Ent. Soc. London 1874: 404.

Paratrechina flavipes. — Emery 1925; Gen. Ins. 183: 420.

Material: United Arab Emirates: 1 ♂, 1 ♀, ♀♀ from: Juneira, 15.IV.1991; Kalba, 30.III.1991; all C. Gosse. — Oman: 1 ♀, Hawiyah, 18.VII.1986, M.D. Gallagher; 1 ♀, Mintirib, III.1986, W. Büttiker.

This yellowish species, like *P. jaegerskioeldi*, is tending to become distributed widely through the temperate regions of the world. It is native to Japan and Korea but there are now many records in the west and from plant houses.

Paratrechina jaegerskioeldi (Mayr, 1904)

Prenolepis jaegerskioeldi Mayr, 1904. — in Jägerskjöld: Res. Swed. Zool. Exp. Egypt White Nile 1: 8.

Paratrechina jaegerskioeldi. — Emery 1925; Gen. Ins. 183: 218.

Material: Yemen: ♀♀ from: Sana'a, IX.1991; Taiz, 20.I.1991; Aden, 18.XII.1991; all A. van Harten.

This is a more localised tramp species that is abundant in many parts of the Middle East. Several collections of this ant have been sent by M.D. Gallagher from domestic and other premises around Muscat in Oman and there are new records.

Paratrechina longicornis (Latreille, 1802)

Formica longicornis Latreille, 1802. — Fourmis: 112.

Paratrechina longicornis. — Emery 1925; Gen. Ins. 183: 217.

Material: Yemen: ♀♀ from: Aden; Zingibar; all H. Wranik; ♀♀ from: Aden; Mabab; Al-Mahwit; all A. van Harten.

There are many locations in the western areas of Yemen for this common tramp species. It flourishes in the humid semi-shade of banana plantations.

Genus *Camponotus* Mayr, 1861

This is a large genus with 25 species now known from Arabia.

Key to species

- | | | |
|----|-----------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|
| 1 | Dorsum of alitrunk interrupted by a deep mesopropodeal furrow | 2 |
| — | Dorsal outline of alitrunk a more or less continuous curve | 4 |
| 2 | Whole body densely sculptured, hairy and opaque; propodeum broadly dentate | |
| | <i>Camponotus sericeus</i> | |
| — | Body weakly sculptured; propodeum obtusely rounded | 3 |
| 3 | Gaster testaceous, paler than brown alitrunk | <i>Camponotus fayfaensis</i> |
| — | Gaster dark, unicolorous with alitrunk | <i>Camponotus ilgii</i> |
| 4 | Gaster dull with close patterned pubescence | 5 |
| — | Gaster more or less shining with sparse pubescence | 6 |
| 5 | Gaster with thick silvery pubescence with a distinct longitudinal pattern at each side of the dorsum; genae uniformly dark | <i>Camponotus flavomarginatus</i> |
| — | Gaster with thinner pubescence with dorsal pattern appearing as a single median band; genae reddish immediately above the mandible insertions | |
| | <i>Camponotus jizani</i> | |
| 6 | Gaster with a distinct pattern of yellow blotches along the sides of the first two tergites | 7 |
| — | Gaster either uniformly dark or with front part of the first tergite pale | 8 |
| 7 | Yellow patches on gaster appear as a row of two or three discrete spots; subcephalic hairs numerous | <i>Camponotus maculatus</i> |
| — | Blotches at sides of gaster merge into each other; subcephalic hairs present but not numerous | <i>Camponotus aegyptiacus</i> |
| 8 | Body colour uniformly dark | 9 |
| — | At least lower part of alitrunk and petiole pale | 15 |
| 9 | Head with front part with large scattered pits; genae with projecting hairs | 10 |
| — | Head with occasional fine punctures, not pits; genae not fringed with projecting hairs | 11 |
| 10 | Whole of head including occiput fringed with short hairs; antennae broadening to apex | <i>Camponotus carbo</i> |
| — | Projecting hairs at sides of head restricted to lower part below eyes; antennae not markedly broadening to apex | <i>Camponotus foraminosus</i> |

| | | | |
|----|-------------------------------------------------------------------------------------------------------------------|-------------------------------------|----|
| 11 | Subcephalic hairs sparse; legs yellow | <i>Camponotus adenensis</i> | |
| – | Subcephalic hairs numerous; legs pale brown | | 12 |
| 12 | Gaster without pubescence, whole body shining | <i>Camponotus thales</i> | |
| – | Gaster with sparse pubescence, head and alitrunk sculptured and dull | | 13 |
| 13 | Occiput viewed in full face with at least one projecting hair at each corner | <i>Camponotus acvapimensis</i> | |
| – | Occiput bare or with projecting hairs restricted to median area | | 14 |
| 14 | Hind tibiae channelled with a few spiny hairs on flexor surface | <i>Camponotus empedocles</i> | |
| – | Hind tibiae not channelled and with a few subdecumbent hairs only | <i>Camponotus kersteni</i> | |
| 15 | Hind tibiae with a row of six or more spiny hairs on flexor surface | | 16 |
| – | Hind tibiae with fine and subdecumbent hairs only | | 22 |
| 16 | At least some subcephalic hairs present on the posteroventral head | | 17 |
| – | Underside of head bare without projecting hairs except close to the mandibles | | 20 |
| 17 | Large workers with whole alitrunk dorsum and head black | | 18 |
| – | All workers with alitrunk predominantly pale | | 19 |
| 18 | Subcephalic hairs numerous | <i>Camponotus somalinus</i> | |
| – | Subcephalic hairs restricted to 2-4 | <i>Camponotus fellah</i> | |
| 19 | Maximum HW 3.3 or less; subcephalic hairs numerous | <i>Camponotus baldacci</i> | |
| – | Maximum HW up to 4.0; subcephalic hairs only 2-4 | <i>Camponotus hova</i> | |
| 20 | First gastral tergite with basal two thirds paler than rest; petiole dorsum steeply rounded | <i>Camponotus oasisium</i> | |
| – | Gaster completely dark or with small yellowish patch at base only; petiole dorsum widely rounded to flat. | | 21 |
| 21 | Dorsum of alitrunk and gaster entirely dark | <i>Camponotus xerxes</i> | |
| – | Gaster with yellowish patch at base, most of alitrunk in part yellowish brown | <i>Camponotus thoracicus</i> | |
| 22 | Subcephalic hairs abundant; gaster entirely dark and somewhat dull with scattered pubescence | <i>Camponotus arabicus</i> | |
| – | Subcephalic hairs sparse or absent; gaster shining partly or entirely yellowish | | 23 |
| 23 | Underside of head with a few hairs; head shining | | 24 |
| – | Underside of head completely bare; head sculptured and dull | <i>Camponotus gallagheri</i> n. sp. | |
| 24 | First gaster tergite and petiole pale yellow; alitrunk entirely or mainly yellowish | <i>Camponotus atlantis</i> | |
| – | First gaster tergite dark; alitrunk dorsum in part shining black | <i>Camponotus alii</i> | |

Camponotus adenensis Emery, 1893

Camponotus maculatus adenensis Emery, 1893. — Ann. Soc. ent. Fr. 62: 257.

Camponotus adenensis. — Collingwood 1985; Fauna of Saudi Arabia 7: 277.

Material: Yemen: ♀♀, Shamsun camp, 17.III.1988, H. Wranik; ♀♀ from: Amran, 20.X.1991; Wadi Surdud, 9.XII.1991; all A. van Harten; ♀♀, Sana'a, 4.III.1993, C.A. Collingwood.

Camponotus aegyptiacus Emery, 1915

Camponotus maculatus aegyptiacus Emery, 1915. — Bull. Soc. ent. Fr. (1914): 79.

Camponotus aegyptiacus. — Baroni Urbani 1972; Verh. naturf. Ges. Basel 82 (1): 130.

Material: Oman: 1 ♀, Jabal Qara, 4.IX.1989, R.P. Whitcombe; ♀♀, Dhalqi Dhofar, 16.IX.1989, M.D. Gallagher. — Yemen: 1 ♂, ♀♀, Aden, 16.IX.1988, H. Wranik; ♀♀ from: Al-Mahwit, 7.VI.1991; Sanhan, 30.VIII.1991; all A. van Harten; ♀♀, Zabid, 26.XII.1992, M. Mahyoub.

This species is generally common throughout Arabia. Males frequently fly to light in the evening.

Camponotus arabicus Collingwood, 1985

Camponotus arabicus Collingwood, 1985. — Fauna of Saudi Arabia 7: 281.

Material: Oman: ♀♀, Qaboos Dhofar, 4.XI.1983, J. Darlington.

Camponotus atlantis Forel, 1890

Camponotus rubripes st. *atlantis* Forel, 1890. — Ann. Soc. ent. Belg. 34: LXIII.

Camponotus atlantis. — Emery 1925; Gen. Ins. 183: 91.

Material: Oman: ♀♀ from: Shuwayiyah, 27.IX.1983; Ras Madrakah, 1.X.1984; all M.D. Gallagher. — Yemen: ♀♀, ♀♀ from: Sana'a, III.1991; Al-Mahwit, 29.IV.1991; Taiz, 20.XI.1991; all A. van Harten; ♀♀, Sumara Pass, 13.III.1993, C.A. Collingwood.

Camponotus carbo Emery, 1877 (Fig. 35)

Camponotus carbo Emery, 1877. — Ann. Mus. civ. Stor. nat. Giacomo Doria 9: 364.

Material: Oman: 1 ♀, Wahiba Sands, 6.III.1986, M.D. Gallagher.

Measurements: HL 3.0; HW 2.3; SL 2.4; EL 0.32.

The clypeus projects slightly in front of the head side margins and has the front border with a broken, bluntly serrated edge. It has a distinct keel which continues posteriorly as an indented line between the frontal ridges. The head is densely sculptured, microreticulate and dull with scattered large punctures towards the genae and across the clypeus and lower frons, also the proximal third of the scape which widens from its narrow base to about 1.5 times its width near the apex. The alitrunk dorsum forms a simple arch in side view but with distinct promesonotal and mesopropodeal sutures. The petiole is a simple scale nearly as high as the propodeum. The dense sculpture of the head continues over the alitrunk; the gaster is more finely reticulostriate and the general appearance is dull without shine. In dorsal view short hairs project round the head from the occiput to the anterior genal margins. There are numerous longer hairs on the pronotum, on the posterior border of the propodeum and on the gastral dorsum.

Camponotus empedocles Emery, 1920

Camponotus thales var. *empedocles* Emery, 1920. — Boll. Soc. ent. Ital. 52: 6.

Camponotus empedocles. — Collingwood 1985; Fauna of Saudi Arabia 7: 279.

Material: Yemen: ♀♀ from: Al-Hajjarah, 14.III.1992; Wadi Surdud, 29.XII.1992; all A. van Harten.

Camponotus fayfaensis Collingwood, 1985

Camponotus fayfaensis Collingwood, 1985. — Fauna of Saudi Arabia 7: 280.

Material: Yemen: ♀♀ from: Taiz – Al-Turbah, 14.III.1993; near Zingibar, 20.III.1993; all C.A. Collingwood.

This species was collected among trees on the coastal belt in Yemen.

Camponotus fellah Dalla Torre, 1893 (Fig. 36)

Camponotus fellah Dalla Torre, 1893. — Cat. Hym. 7: 245.

Material: Saudi Arabia: ♀♀ from: Wadi Khumra, V.1979; Al-Jarf, XI.1976; all W. Büttiker. — Kuwait: 1 ♀, Anwha Island, 29.III.1988, W. Büttiker. — United Arab Emirates: 1 ♀, Djebel Haffete, 4.X.1989, H. Heatwole. — Oman: ♂♂, ♀♀, ♀♀ from: Wadi Hisma, 5.XII.1984; Ras al-Marran, 16.IX.1985; Ras al-Junayz, 2.II.1988; Tayah salt marsh, 10.II.1992; all M.D. Gallagher. — Yemen: ♀♀, Shabruah, 21.III.1991, M. Knapp; ♀♀, Zingibar-Shugra, 21.III.1993, C.A. Collingwood.

Camponotus flavomarginatus Mayr, 1862

Camponotus flavomarginatus Mayr, 1862. — Verh. zool.-bot. Ges. Wien 12: 664.

Material: Oman: ♀♀, Jabal Samhan, 1.IX.1989, M.D. Gallagher. — Yemen: ♀♀, Al-Mahwit, 29.IV.1991, A. van Harten; ♀♀ from: Sumara Pass, 13.III.1993; Sangani Pass, 13.III.1993; Bajil-Khamis Bani Sad, 16.III.1993; all C.A. Collingwood.

Camponotus foraminosus Forel, 1879

Camponotus foraminosus Forel, 1879. — Bull. Soc. Vaud. Sci. nat. 16: 87.

Material: Saudi Arabia: ♀♀ from: Wadi Shuqub, 20.IX.1979; Tabuk, XI.1988; all W. Büttiker. — Oman: 1 ♀, Ain Umran, 16.IX.1979, M.D. Gallagher. — Yemen: 1 ♀, Mabbar, at light, VIII.1992, A. van Harten; 1 ♀, Bajil-Khamis Bani Sad, 16.III.1993, C.A. Collingwood.

Camponotus gallagheri n. sp. (Fig. 37)

Holotype: ♀, Oman, Jabal Shams, 1.X.1990, M.D. Gallagher. — Paratypes: 4 ♀♀, same series as holotype.

Measurements of holotype: TL 12.8; HL 3.16; HW 2.84; SL 3.21; alitrunk length 5.2; PW 0.76.

Description: The head is distinctly emarginate. There are no subcephalic hairs posterior to the mandibles. The alitrunk dorsum has two pairs of hairs on the pronotum, one pair on the mesonotum, four on the propodeum, one on the petiole and one on the first gastral tergite. The petiole has rounded sides and a flattened dorsal crest. The hind tibiae have decumbent pubescence but no suberect spiny hairs. The head and alitrunk dorsum are dark brown, the rest of the alitrunk petiole and gaster yellowish brown. The paratype minor workers are evenly yellowish brown. The five workers were collected above 2000 m.

Affinities: The affinities of this species appear to be with the *C. thraso* group but the denser sculpture of the head and alitrunk and the relatively large size of the major worker resemble more *C. thoracicus* and allied species.

Camponotus hova Forel, 1891

Camponotus hova Forel, 1891. — Hist. phys. nat. polit. Madag. 20: 35.

Material: Oman: 1 ♀, W of Muscat, 26.IX.1984, M.D. Gallagher. — Yemen: 1 ♀, Jal Witlaidon, II.1985, H. Materlik; ♀♀, Socotra – Nogeed, 16.IV.1993, A. van Harten.

This species is widely recorded from islands off East Africa.

Camponotus ilgii Forel, 1894

Camponotus ilgii Forel, 1894. — Mitt. Schweiz. ent. Ges. 9: 64.

Material: Oman: ♀♀, Jabal Samhan, 28.IX.1984, M.D. Gallagher. — Yemen: ♀♀ from: Wadi Wazanan, 14.III.1993; Bani, 20.III.1993; all C.A. Collingwood.

This species was collected among trees on the coastal belt in Yemen; it was taken singly on trees with *Crematogaster affabilis*.

Camponotus jizani Collingwood, 1985

Camponotus jizani Collingwood, 1985. — Fauna of Saudi Arabia 7: 281.

Material: Oman: ♀♀, Jabal Qarn, 22.IX.1984, M.D. Gallagher. — Saudi Arabia: ♀♀, Barithi, 5.X.1984, W. Büttiker. — Yemen: ♀♀ from: Rissabah, 8.X.1991; Taiz, 29.X.1991; Amran, 11.II.1992; Al-Mahwit, 16.III.1992; all A. van Harten; ♀♀ from: Mabbar, 8.III.1993; Taiz – Al-Turbah, 14.III.1993; Sana'a, 9.III.1993; all C.A. Collingwood.

This species is abundant in the lower valleys of south-west Yemen just as it was around Fayfa in Saudi Arabia while the rather similar *C. flavomarginatus* seems to be more restricted to the mountains where, as in the Asir mountains and the Sumara and Sangani passes in Yemen, it occurred on rugged land over 2200 m.

***Camponotus kersteni* Gerstaecker, 1871**

Camponotus kersteni Gerstaecker, 1871. — Arch. Naturgesch. 37: 355.

Material: Yemen: ♀♀ from: Hammam Ali, 10.II.1992; Mocha Gocha, 23.III.1992; all A. van Harten.

***Camponotus maculatus* (Fabricius, 1781)**

Formica maculata Fabricius, 1781. — Spec. Insect. 1: 491.

Camponotus maculatus. — Mayr 1862; Verh. zool.-bot. Ges. Wien 12: 654.

Material: Oman: 1 ♀, Afrad Batina, 26.III.1989, R.P. Whitcombe. — Yemen: ♀♀ from: Qa al-Boun, VIII.1992; Wadi Wazanan, 14.III.1993; all A. van Harten; ♀♀, Taiz – Al-Turbah, 14.III.1993, C.A. Collingwood.

This common African species is evidently restricted to the southern, warmer valleys of Arabia.

***Camponotus oasium* Forel, 1890**

Camponotus rubriceps r. *oasium* Forel, 1890. — Ann. Soc. ent. Belg. 34: LXV.

Camponotus oasium. — Collingwood 1961; Vidensk. Medd. Dansk Naturh. Foren. 123: 75.

Material: Saudi Arabia: 1 ♀, Abu Arish, 26.III.1983, C.A. Collingwood. — United Arab Emirates: ♀♀, Umm al-Zamul, 16.XII.1993, B. Tigar. — Oman: ♀♀ from: Banidat Khraim, 2.X.1983; Jabal Akhdar, 30.V.1987; all M.D. Gallagher; 1 ♀, Jabal Akhdar, 21.II.1986, W. Büttiker.

***Camponotus sericeus* (Fabricius, 1798)**

Formica sericea Fabricius, 1798. — Suppl. Ent. Syst.: 279.

Camponotus sericeus. — Mayr 1862; Verh. zool.-bot. Ges. Wien 12: 675.

There are many records for this conspicuous and common species throughout western and central Arabia including Saudi Arabia, Oman and Yemen. In Yemen it has been taken near Aden by H. Wranik; Zabid, Hammam Ali, Marib, Sana'a, Wadi Bani, Mafhaq, Al-Mahwit and Madinat al-Shariq by A. van Harten and others. Unlike many of the larger *Camponotus* species which are generally nocturnal, this ant, itself large and conspicuous, forages throughout the day.

***Camponotus somalinus* André, 1887 (Fig. 38)**

Camponotus somalinus André, 1887. — Rev. ent. Caen 6: 20.

Material: Oman: 1 ♂, 1 ♀ from: Sur Creek, XII.1988; Muscat, 5.IX.1989; all M.D. Gallagher. — Yemen: ♀♀, Sana'a, III.1991, A. van Harten; ♀♀, Wadi Udain, 13.III.1993, C.A. Collingwood.

This black species is like *C. fellah* but has more body hairs and there are 8-12 hairs on the ventral head compared with *C. fellah* where there are 2-4. This pilosity difference occurs in all castes. *C. somalinus* was described from East Africa.

***Camponotus thoracicus* (Fabricius, 1804)**

Formica thoracica Fabricius, 1804. — Syst. Piez.: 397.

Camponotus thoracicus. — Roger 1862; Berl. ent. Z. 6: 205.

Material: Saudi Arabia: ♀♀, ♀♀ from: Wadi Tumair, III.1976; Wadi Mutaywiyah, IX.1976; Buwaybiyat, II.1977; Hofuf, X.1978; all W. Büttiker. — Kuwait: ♀♀, Wadi Umm al-Rumais, 20.II.1988, W. Büttiker. — United Arab Emirates: ♀♀, Baynunah, 12.XI.1993, B. Tigar. — Oman: 1 ♀, Yalooni, 18.VI.1988, K. Stanley-Price; 1 ♀, ♀♀, Thibar, 12.III.1992, M.D. Gallagher. — Yemen: ♀♀, Thibar, 12.III.1992, A. van Harten.

***Camponotus xerxes* Forel, 1904**

Camponotus maculatus r. *xerxes* Forel, 1894. — Ann. Soc. ent. Belg. 48: 424.

Material: Saudi Arabia: ♂♂, ♀♀, ♀♀ from: Wadi Durmah, Wadi Mizbil, Dammam, Wadi Muraywah, 1975-1979; all W. Büttiker. — Kuwait: ♀♀, Jal al-Zour, 6.II.1988, W. Büttiker. — United Arab Emirates: ♀♀, Ras Ghanada, IX.1992, B. Tigar. — Oman: ♀♀, Thumrait, VI.1984, J.M. Barnes; ♀♀, Ras Dhabdhub, 14.I.1986, M.D. Gallagher.

This is the commonest of the larger *Camponotus* species in Saudi Arabia. Additional records to the many in COLLINGWOOD (1985) are given above. This species has a wide range from Central

Asia to the Middle East and Arabia but does not seem to occur in the south west of Saudi Arabia or in Yemen where it is probably replaced by the similar *C. fellah*. The delimitation of these two large nocturnal foraging species however is not too clear and both species occur in similar habitats in the United Arab Emirates.

Genus *Polyrhachis* Smith, 1863

Key to species

- 1 Petiole with large lateral spines set horizontally, median spines absent or reduced to small prominences; propodeal spines long and curved *Polyrhachis lacteipennis*
- Petiole with large lateral spines directed upwards, the intermediate spines short and dentate; propodeal spines very short *Polyrhachis viscosa*

Polyrhachis lacteipennis F. Smith, 1838

Polyrhachis lacteipennis F. Smith, 1838. — J. Proc. Linn. Soc. Lond. Zool. 2: 60.

Polyrhachis simplex Mayr. — Collingwood 1985; Fauna of Saudi Arabia 7: 274 [supposed synonym].

Material: Oman: ♀♀, Wadi Fanjan, 9.IV.1985, C. Holzschuh; ♀♀ from: Al-Khuwayr, 2.XI.1983; Wadi Andaq, 25.IX.1984; Mintirib, 17.XI.1984; Khawr Sawli, 18.I.1985; all M.D. Gallagher. — Yemen: ♀♀, Aden Chalet, 29.X.1988, H. Wranik.

The previous records from Al-Qatif, Saudi Arabia and Khabura, Oman (COLLINGWOOD 1985) should refer to this species, not to *P. simplex* Mayr, 1862 which is probably a synonym.

Polyrhachis viscosa F. Smith, 1858

Polyrhachis viscosa F. Smith, 1858. — Cat. Hym. Brit. Mus. 6: 71.

Material: Yemen: ♀♀, near Al-Mahwit, 10.III.1993, C.A. Collingwood.

A small colony was found nesting under a stone among dwarf palms.

Genus *Cataglyphis* Foerster, 1850

Ants of genus *Cataglyphis* have been reclassified, and a synopsis and key to the species groups are provided by AGOSTI (1990). Agosti & Collingwood are currently revising the North African and Arabian species of the *C. bicolor* group, resulting in some name changes since COLLINGWOOD (1985). Those changes are here indicated, but detailed descriptions of the species and of the proposed synonymy will be given there. Furthermore, it is questioned whether allopatric populations with distinct characters should be treated as one or several species. This concerns mainly the better known species of the *C. bicolor* species group, such as *C. adenensis*, *C. laevior*, *C. isis* and *C. diehli* since all the populations reviewed are allopatric and somewhat variable. These names are retained in the present paper until further experience indicates conclusively that the three synonymised forms are indeed always allopatric.

Key to species

- 1 Petiole a truncated node with a flat dorsal surface sloping forward (*C. albicans* group) 2
- Petiole a rounded node or an upright thick scale 11

| | | |
|----|-----------------------------------------------------------------------------------------------------------------------------------|----|
| 2 | Body colour uniformly shining black | 3 |
| — | Colour otherwise | 6 |
| 3 | HW of largest workers less than 1.2; scape longer than HW <i>Cataglyphis minimus</i> | |
| — | HW of largest workers 2.0 or more; scape shorter than HW | 4 |
| 4 | Node steeply sloped and high; height to length 4.8:3 <i>Cataglyphis acutinodis</i> n. sp. | |
| — | Node with flat slope; height to length 4.5:4 | 5 |
| 5 | Head unsculptured, brilliant <i>Cataglyphis vaucheri</i> | |
| — | Head sculptured <i>Cataglyphis albicans</i> | |
| 6 | Head, alitrunk and gaster unicolorous; antennal scape shorter than head length | 7 |
| — | Bicoloured with at least head paler than gaster; antennal scape longer than head length | 9 |
| 7 | Whole body a deep brown colour; petiole relatively narrow, higher than long in profile <i>Cataglyphis cinnamomeus</i> | |
| — | Whole body yellow or light brown; petiole broader, not higher than long | 8 |
| 8 | Whole body golden brown <i>Cataglyphis auratus</i> | |
| — | Whole body yellow <i>Cataglyphis lividus</i> | |
| 9 | Gaster entirely dark; head red | 10 |
| — | Gaster with only apical segments dark and first tergite unicolorous yellow with head and alitrunk <i>Cataglyphis arenarius</i> | |
| 10 | Head and pronotum dull red, sculptured <i>Cataglyphis semitonsus</i> | |
| — | Head and entire alitrunk bright red <i>Cataglyphis ruber</i> | |
| 11 | Petiole an upright scale | 12 |
| — | Petiole a rounded node | 14 |
| 12 | Body entirely yellow; third maxillary palp long with long curved hairs (<i>C. bombycinus</i> group) <i>Cataglyphis sabulosus</i> | |
| — | Body mainly or entirely dark; third maxillary palp shorter without long curved hairs | 13 |
| 13 | Funiculus segments 2-7 short, quadrate (<i>C. emmae</i> group) <i>Cataglyphis emmae</i> | |
| — | Funiculus segments all longer than broad (<i>C. anescens</i> group ?) <i>Cataglyphis shuaibensis</i> n. sp. | |
| 14 | Maxillary palps short, segment 4 shorter than 5 + 6 (<i>C. altisquamis</i> group) | 15 |
| — | Maxillary palps long, segment 4 longer than 5 + 6 (<i>C. bicolor</i> group) | 17 |
| 15 | Alitrunk entirely without dorsal hairs; whole body opaque <i>Cataglyphis opacior</i> n. sp. | |
| — | Dorsal alitrunk hairs present | 16 |
| 16 | Whole of alitrunk clothed with stout black hairs <i>Cataglyphis asiriensis</i> | |
| — | Alitrunk hairs restricted to a few on pronotum and on posterior part of propodeum only <i>Cataglyphis harteni</i> n. sp. | |
| 17 | Petiole a high rounded node; first funiculus segment 1.3-1.5 times longer than funiculus segment 2 | 18 |
| — | Petiole lower or more massive; first funiculus segment at least 1.7 times longer than funiculus segment 2 | 22 |
| 18 | Body colour evenly dark or black | 19 |
| — | Body colour yellowish or bicoloured | 20 |
| 19 | Gaster mildly sculptured and dull; antennal scapes with occasional erect hairs <i>Cataglyphis isis</i> | |
| — | Gaster brilliant; antennal scapes without erect hairs <i>Cataglyphis diehli</i> | |

- 20 Whole body including head and gaster yellowish brown
Cataglyphis flavobrunneus n. sp.
- Gaster dark, contrasting with red head 21
- 21 Head slightly or not longer than wide; petiole dorsum mildly flattened
Cataglyphis adenensis
- Head distinctly longer than wide; petiole dorsum smoothly rounded
Cataglyphis laevior
- 22 Body colour dark without distinct colour contrast 23
- At least head and/or alitrunk red, contrasting with dark gaster 26
- 23 Propodeum high, relatively massive with the dorsal and descending faces meeting at a rounded right angle
Cataglyphis holgerseni n. sp.
- Propodeal dorsum rounds evenly into its descending face 24
- 24 Petiole a large rounded dome 25
- Petiole lower, either longer than high or with anterodorsal face slightly flattened, propodeum high with dorsal and descending faces meeting at a rounded right angle
Cataglyphis urens
- 25 Propodeum high and steeply rounded; head unicolorous with alitrunk
Cataglyphis savignyi
- Propodeum lower with a flatter curvature; head often obscurely reddish
Cataglyphis niger
- 26 Petiole low, longer than high in profile
Cataglyphis abyssinicus
- Petiole higher with a somewhat flattened anterodorsal slope
Cataglyphis sp.

Cataglyphis abyssinicus (Forel, 1904)

Myrmecocystus viaticus st. *abyssinicus* Forel, 1904. — Ezheg. zool. Mus. Imp. Akad. Nauk 8: 282.

Cataglyphis abyssinicus. — Collingwood 1985; Fauna of Saudi Arabia 7: 286.

Material: Oman: ♀♀, Qurm Nature Reserve, 30.I.1987, M.D. Gallagher; 1 ♀, Wahiba, I.1985, P.W. Munton. — Yemen: ♀♀, Sana'a, V.1991, A. van Harten; ♀♀, Sana'a, 4.III.1993, C.A. Collingwood.

This species may be wrongly named since, according to AGOSTI (1994), the type series might include a mixed series of worker and inquiline females, belonging to another species.

Cataglyphis acutinodis n. sp. (Fig. 39)

Holotype: ♀, Yemen, Sana'a, IX.1992, A. van Harten. — Paratypes: Yemen: ♀♀, same series as holotype; ♀♀, Al-Mahwit, 21.IX.1991, A. van Harten. — Oman: ♀♀ from: Samhan, 8.III.1993; Al-Mahwit, 8.III.1993; Sana'a, 10.III.1993; all C.A. Collingwood.

Measurements of holotype: TL 5.6; HL 1.46; HW 1.32; SL 1.24; EL 0.40; SI 85.

Description: This black species differs from *C. albicans* by the higher, steeper petiole; ratio height to length 4.8:3.0 (*C. albicans* 4.5:4.0). The antennae, tibiae and tarsi are yellow; in *C. albicans* from Saudi Arabia these are pale brown.

Affinities: There are similar examples taken by H. Heatwole in the Chinese Gobi near Urumchi.

Cataglyphis adenensis (Forel, 1904)

Myrmecocystus viaticus r. *adenensis* Forel, 1904. — Ezheg. zool. Mus. Imp. Akad. Nauk 8: 382 (footnote).

Cataglyphis adenensis. — Santschi, 1929; Rev. Suisse Zool. 36: 41.

Material: Oman: 1 ♀, Mugshin Dhofar, 20.IX.1979, R.P. Whitcombe. — Yemen: 1 ♀, ♀♀ from: Mafhaq, 9.III.1993; Taiz – Al-Turbah, 14.III.1993; Shugra-Lauder, 21.III.1993; all C.A. Collingwood; ♀♀, Damt, 29.III.1993, A. van Harten.

This species has a short broad head which is bright red. The petiole is high like in *C. flavobrunneus* n. sp., but the dorsum is sloped rather than smoothly rounded.

***Cataglyphis arenarius* Finzi, 1940**

Cataglyphis arenarius Finzi, 1940. — Mem. Soc. ent. Ital. 18: 163.

Material: Oman: ♀♀, Mugshin Dhofar, 20.IX.1979, R.P. Whitcombe.

Measurements: SI 110-116.

These ants have a yellowish body colour except for the gaster which is dark from the posterior edge of the first tergite. The petiole in profile is shorter and has a flatter dorsum than *C. ruber*. This species and *C. auratus*, *C. cinnamomeus*, *C. lividus*, *C. ruber* and *C. semitonsus*, belong to the *C. albicans* species complex.

***Cataglyphis auratus* Menozzi, 1932 n. stat.**

Cataglyphis albicans var. *aurata* Menozzi, 1932. — Boll. Soc. ent. Ital. 64: 95.

Material: Saudi Arabia: ♀♀, Kushm Dibi, 10.V.1981, W. Büttiker.

This species and *C. auratus*, *C. cinnamomeus*, *C. lividus*, *C. ruber* and *C. semitonsus*, belong to the *C. albicans* species complex. *C. auratus* is golden brown in colour. The head and alitrunk have fine reticulate sculpture. Decumbent pubescence is well developed on the occiput and on the dorsum and sides of the propodeum. The gaster is brilliant with no dorsal hairs or pubescence. This species was described from the Sudan.

***Cataglyphis cinnamomeus* (Karawaiew, 1910) (Fig. 40)**

Myrmecocystus albicans cinnamomeus Karawaiew, 1910. — Russk. ent. Obozr. 9: 269.

Cataglyphis cinnamomea. — Pisarski 1967; Ann. Zool. Polska Akad. Nauk 24: 418.

Material: Saudi Arabia: ♀♀, Wadi Tumair, 20.II.1976, W. Büttiker.

Measurements: SI 91.7.

This is a deep brown, rather sculptured species with a more rounded narrower petiole compared with *C. albicans*. It was described from Central Asia but also occurs in Afghanistan and Tunisia.

***Cataglyphis diehli* (Forel, 1902)**

Myrmecocystus viaticus r. *diehli* Forel, 1902. — Ann. Soc. ent. Belg. 46: 462.

Cataglyphis diehli. — Collingwood 1985; Fauna of Saudi Arabia 7: 287.

Material: Kuwait: ♀♀, Sulabiyah, 14.III.1988, W. Büttiker. — Oman: ♀♀, Rima Oil Camp, IX.1984, M.D. Gallagher; 1 ♀, Batina, 5.I.1980, R.P. Whitcombe.

This species and *C. isis*, *C. laevior*, and *C. flavobrunneus* n. sp. are distinguished from others in the *C. bicolor* group by the shorter funiculus segments, the high narrow petiole, the long, slit-shaped propodeal spiracle and the extremely flat propodeum of small workers.

***Cataglyphis emmae* (Forel, 1909)**

Formica (Proformica) emmae Forel, 1909. — Bull. Soc. Vaud. Sci. nat. 45: 381.

Cataglyphis emmae. — Santschi 1929; Rev. Suisse Zool. 36: 30.

Material: Saudi Arabia: 1 ♀, Wadi Tumair, 17.II.1976, W. Büttiker.

***Cataglyphis flavobrunneus* n. sp. (Fig. 41)**

Holotype: ♀, Oman, Mintirib, 18.II.1986, W. Büttiker. — Paratypes: Oman: ♀♀, same series as holotype; ♀♀ from: Qarn al-Alam, 31.V.1984; Dhabdhub, 29.V.1986; Sur Creek, 26.IX.1986; Ras al-Hadd, 21.II.1992; all M.D. Gallagher. — Saudi Arabia: 1 ♀, Jeddah, 19.II.1978, W. Büttiker. — United Arab Emirates: 1 ♀, Djebel Haffete, X.1989, H. Heatwole; ♀♀, Ras Ghanada, IX.1992, B. Tigar. — Yemen: 1 ♀, Aden, 5.XI.1988, H. Wranik.

Measurements of holotype: TL 8.9; HL 2.2; HW 2.15; SL 2.32; EL 0.58.

Description: The first funiculus segment is 1.29 longer than segment 2; the petiole is a high rounded dome as in *C. laevior*, *C. diehli* and *C. isis*. This species has similar features to *C. laevior* but is entirely bright yellowish brown including the antennae and legs without dark markings. The head is smooth and polished with superficial reticulate sculpture. Most specimens were taken as single individuals.

Two worker specimens taken in Oman, Ras al-Hadd by M.D. Gallagher have the same appearance and colour to *C. flavobrunneus* with the same narrow-domed node but the funiculus segments are longer. Their first funiculus segment is 1.45-1.75 longer than funiculus segment 2. Also the head sculpture is more distinct giving a grainy appearance. More material is needed to establish whether these represent another species.

Cataglyphis harteni n. sp. (Fig. 42)

Holotype: ♀, Yemen, Djebel an-Nabi Shuaib, 11.IX.1992, A. van Harten. — Paratypes: Yemen: 4 ♀♀, same series as holotype; 10 ♀♀, same locality, 7.III.1993, C.A. Collingwood.

Measurements of holotype: TL 5.25; HL 1.94; HW 1.52; SL 1.94; PW 0.43; PL 0.33; EL 0.60.

Description: There is one pair of coarse hairs on the pronotum and one pair on the posterior dorsum of the propodeum, two pairs on the petiole and one pair on the first gastral tergite. The first funiculus segment is 1.56 times segment 2. The third and fourth maxillary palp segments are each shorter than the fifth and sixth combined. The petiole is a high thick node with a distinctly convex anterior face and a steep posterior face. The propodeum is rather low with the dorsal face sloping gently into its declivous face. The colour is uniformly dull black with dense reticulate sculpture extending over the head, alitrunk and first gaster tergite. The eyes are somewhat bulbous and project from the side margins of the head in posterior view. The inner faces of the femora and tibiae have thick black bristles.

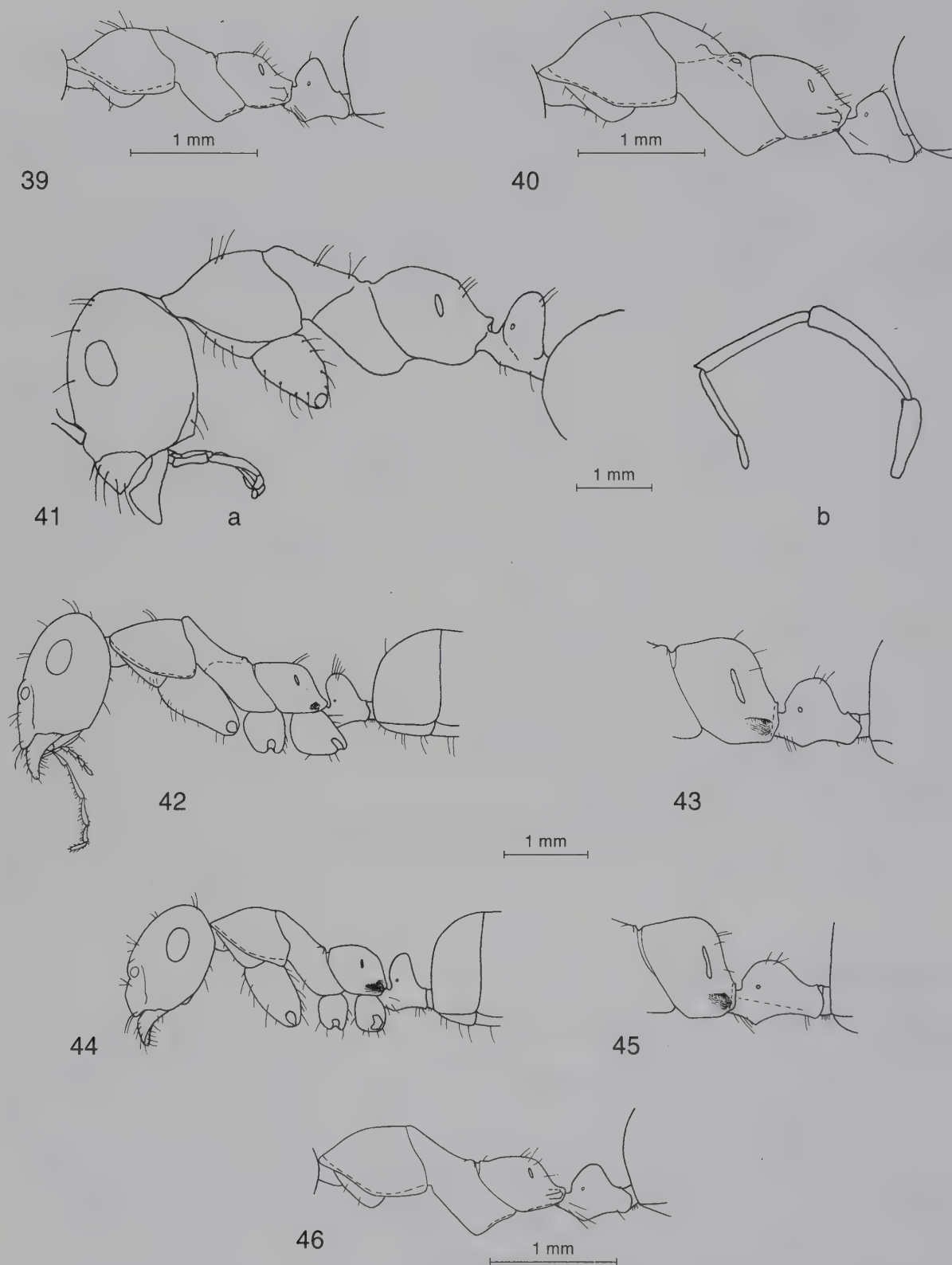
Affinities: This species belongs to the *C. altisquamis* complex and closely resembles *C. asiriensis* Collingwood, 1985 except for the much reduced dorsal pilosity of the alitrunk and gaster. This species occurred high up on the eastern side of the mountain mass of Djebel an-Nabi Shuaib at altitudes over 3500 m.

Cataglyphis holgerseni n. sp.

Holotype: ♀, Sinai, near Eilat, 23.XII.1978, H. Holgersen. — Paratypes: Sinai: ♀♀, same series as holotype. — Saudi Arabia: ♀♀, ♀♀ from: Al-Qatif, 12.IV.1983; Riyadh, 22.III.1983; all C.A. Collingwood. — Oman: 1 ♀, Thumrait, VI.1984, J.M. Barnes.

This species was confused with *C. niger* in the earlier paper and was not recognised as distinct until Holger Holgersen kindly sent us some ants from the Middle East. Among these were examples of the present species from Sinai. These are immediately distinguishable from other black *Cataglyphis* by the high-raised propodeum. In profile the dorsal and descending face of the propodeum form a rounded right angle as in the red species *C. urens*. *Cataglyphis holgerseni* is one of the largest of the Arabian *Cataglyphis* and cannot be confused with any other species by its colour and propodeal shape. The petiole is also relatively massive as in *C. niger* and more so than in its sister species *C. urens*.

Affinities: *Cataglyphis savignyi* also has a high propodeum but this is smoothly rounded. Examples of *C. holgerseni* from the type locality in Sinai are present in the Copenhagen Zoological Museum, and were misidentified as *C. caerulea* Santschi, 1929. Many examples of the dark



Figs 39-46: Profiles of *Cataglyphis* species: 39, *C. acutinodis* n. sp., ♀, propodeum and node; 40, *C. cinnamomeus*, ♀, propodeum and node; 41, *C. flavobrunneus* n. sp., ♀: a, head and alitrunk; b, antenna; 42, *C. harteni* n. sp., ♀, head and alitrunk; 43, *C. niger*, ♀, propodeum and node; 44, *C. opacior* n. sp., ♀, head and alitrunk; 45, *C. urens*, ♀, propodeum and node; 46, *C. vaucheri*, ♀, propodeum and node.

species in the *C. bicolor* group may show a somewhat purplish tinge and this name has no taxonomic status (AGOSTI 1990).

Cataglyphis isis Forel, 1913

Cataglyphis diehli var. *isis* Forel, 1913. — Rev. Suisse Zool. 21: 434.

Cataglyphis isis. — Pisarski 1967; Ann. zool. Warsz. 24 (6): 421.

Material: Oman: ♀♀, Daraib Dhofar, 24.IV.1984, J. Darlington.

Cataglyphis laevior Santschi, 1929

Cataglyphis bicolor st. *laevior* Santschi, 1929. — Rev. Suisse Zool. 36: 47.

Cataglyphis laevior. — Collingwood 1985; Fauna of Saudi Arabia 7: 288.

Material: Kuwait: ♀♀, Jabal Liyah, 15.II.1988, W. Büttiker. — United Arab Emirates: ♀♀, Baynunah, 8.VI.1993, B. Tigar.

Cataglyphis lividus (André, 1881)

Myrmecocystus albicans var. *livida* André, 1881. — Ann. Soc. ent. Fr. 6 (1): 58.

Cataglyphis lividus. — Arnoldi 1964; Zool. Zh. 43: 1810.

Material: Saudi Arabia: ♀♀ from: Wadi Khumra, 7.I.1976; Diriyah, 10.IX.1977; all W. Büttiker. — Kuwait: ♀♀, Wadi Umm al-Rumais, 20.II.1984, W. Büttiker. — United Arab Emirates: 1 ♀, Djebel Haffete, X.1989, H. Heatwole; ♀♀, Ras Ghanada, IX.1992, B. Tigar. — Oman: ♀♀ from: Wadi Kawrah, 1.X.1984; Qurm Creek, 6.XI.1987; Tawr um Halq, 13.II.1988 Al-Khuwayr, IX.1989; all M.D. Gallagher. — Yemen: ♀♀ from: Zabid, 15.III.1993; Damt-Aden, 20.III.1993; Zingibar, 20.III.1993; all A. van Harten, C.A. Collingwood.

Measurements: SI 111.5.

This yellow species is one of the most widely distributed of the smaller *Cataglyphis* throughout Arabia.

Cataglyphis minimus Collingwood, 1985

Cataglyphis minima Collingwood, 1985. — Fauna of Saudi Arabia 7: 289.

Material: United Arab Emirates: ♀♀, Ras Ghanada, IX.1992, B. Tigar.

Measurements: SI 123-124.

A large number of this very small species in the *C. albicans* group was collected by pitfall trapping at Ras Ghanada. All workers obtained were of approximately even size.

Cataglyphis niger (André, 1881) (Fig. 43)

Myrmecocystus viaticus var. *niger* André, 1881. — Ann. Soc. ent. Fr. (6) 1: 56.

Cataglyphis niger. — Collingwood 1985; Fauna of Saudi Arabia 7: 290.

Material: Kuwait: ♀♀, Wadi Umm al-Rumam 20.II.1988, W. Büttiker. — Oman: Jabal Akhdar, Ibri, Batina, Khabura, Jabal Shams, and other localities; all M.D. Gallagher. — Yemen: ♀♀, Sana'a, V.1991, A. van Harten.

This large black species is widely distributed throughout Arabia and all the countries of the Middle East.

Cataglyphis opacior n. sp. (Fig. 44)

Holotype: ♀, Yemen, Djebel an-Nabi Shuaib, 18.III.1993, C.A. Collingwood. — Paratypes: Yemen: 2 ♀♀, Sumara Pass, 2500 m, 13.III.1993, C.A. Collingwood.

Description: This species is very similar to *C. harteni* n. sp., except for the complete absence of suberect dorsal hairs on the alitrunk and gaster. The whole body is densely sculptured and dull.

Cataglyphis ruber (Forel, 1903)

Myrmecocystus albicans rubra Forel, 1903. — Ann. Soc. ent. Belg. 47: 268.

Cataglyphis albicans ruber. — Emery 1912; Zool. Jb. Suppl. 15 (1): 99.

Cataglyphis ruber. — Collingwood 1985; Fauna of Saudi Arabia 7: 291.

Material: Saudi Arabia: ♀♀ from: Wadi Tumair, 17.II.1976; Riyadh, 29.V.1976; all W. Büttiker. — Oman: ♀♀ from: Barr al-Hickman, 12.II.1987; Madinat Qaboos, 4.XI.1989; all M.D. Gallagher.

Measurements: SI 100.

This vivid red species has the entire gaster dark. This is a first record for Saudi Arabia.

Cataglyphis sabulosus Kugler, 1981

Cataglyphis sabulosa Kugler, 1981. — Israel J. Ent. 15: 84.

Material: Oman: 1 ♀, Al-Khuwayr, I.1990, K. Mathias; 1 ♀, Qarhat Mu'amar, 20.II.1986, W. Büttiker. — United Arab Emirates: 1 ♀, Djebel Haffete, X.1989, H. Heatwole; ♀♀, Ras Ghanada, XI.1992, B. Tigar.

This is the only species of the *C. bombycinus* species group known from Arabia up to the present.

Cataglyphis savignyi (Dufour, 1862)

Formica savignyi Dufour, 1862. — Ann. Soc. ent. Fr. (4) 2: 141.

Cataglyphis savignyi. — Roger 1863; Berl. ent. Z. 7: 12.

Material: Oman: ♀♀ from: Montasar, 14.IX.1984; Qarhat Mu'amar, 20.II.1986; all M.D. Gallagher; ♀♀, Wahiba, 23.III.1986, W. Büttiker. — Yemen: ♀♀, Taiz – Mafhaq, 15.III.1993, C.A. Collingwood.

This species is rather similar to *Cataglyphis* sp. but has the petiole more massive. The propodeum is more raised than in *C. niger*. It is known otherwise from the northern fringe of the Saharan desert from the Atlantic to the northern Sinai.

Cataglyphis semitonsus Santschi, 1929

Cataglyphis albicans var. *semitonsa* Santschi, 1929. — Rev. Suisse Zool. 36: 61.

Cataglyphis semitonsa. — Collingwood 1985; Fauna of Saudi Arabia 7: 291.

Material: Saudi Arabia: ♀♀, Wadi Majarish, 27.IV.1983, W. Büttiker. — Yemen: 1 ♀, Sana'a, IV.1991, A. van Harten; 1 ♀, Samhan, 8.III.1993, C.A. Collingwood.

Measurements: SI 94-95.

This Middle Eastern species has a red head and pronotum with the body progressively darkening posteriorly.

Cataglyphis shuaibensis n. sp.

Holotype: ♀, Yemen, Djebel an-Nabi Shuaib, 18.III.1993, C.A. Collingwood. — Paratypes: ♂♂, ♀♀, same series as holotype and nests from the same locality.

Measurements of holotype: TL 6.3; HL 1.60; HW 1.32; SL 1.64; EL 0.42; PW 0.82; PL 0.29.

Description: Colour totally black except for mid-brown tarsi. The gaster is brilliant and the head, alitrunk and petiole are shining with superficial reticulate sculpture. There are no dorsal hairs on the alitrunk, three pairs on the first tergite dorsum and there are long hairs on the inside femora and tibiae. The propodeum is high with the dorsal and descending faces of nearly equal length. The group of nests was found in a protected south-facing terrace just below the summit of Djebel an-Nabi Shuaib at approximately 3300 m.

Affinities: This species comes near to *C. aenescens* (Nylander, 1849) and allied species in south-eastern Europe and Turkestan.

Cataglyphis urens Collingwood, 1985 (Fig. 45)

Cataglyphis urens Collingwood, 1985. — Fauna of Saudi Arabia 7: 290.

Cataglyphis saharae Santschi. — Collingwood 1985; Fauna of Saudi Arabia 7: 291 [misidentification].

Material: Oman: ♀♀ from: Tibat Musandham, 24.X.1982; Mugshin, Dhofar, 5.X.1989; all M.D. Gallagher; ♀♀, Al-Khuwayr, V.1990, R. Mathias. — Yemen: ♀♀ from: Marib, 4.VI.1991; Shabwah, 21.III.1992; all A. van Harten. — United Arab Emirates: ♀♀ from: Madinat al-Zayed, 14.X.1993; Merewah, 5.VI.1993; all B. Tigar.

This bright red species with the high-raised propodeum has so far only been taken in the south and south-west of the Arabian Peninsula below 25°30'N and is not known from outside Arabia. The specimens along the Arabian Gulf coast in the United Arab Emirates have sometimes some variation of propodeal height within one single nest.

Cataglyphis vaucheri (Emery, 1906) n. stat. (Fig. 46)

Myrmecocystus albicans vaucheri Emery, 1906. — Mem. R. Acad. Sci. Ist. Bologna (6) 3: 54.

Material: Oman: ♀♀, Jabal Samhan, 20.I.1984, M.D. Gallagher. — Yemen: ♀♀, Wadi Damt, 29.III.1993, A. van Harten.

Measurements: SI 99-100.

This black species is distinguished from *C. albicans* by the reduced sculpture. The head, which is wider relative to the promesonotum compared with *C. albicans*, is brilliant and the alitrunk has very superficial sculpture. *C. vaucheri* was described from Morocco.

Cataglyphis sp.

Cataglyphis desertorum. — Collingwood 1985; Fauna of Saudi Arabia 7: 286 [misidentification].

This is the commonest *Cataglyphis* species throughout Arabia and there are many collections from the southern Sinai Peninsula to Saudi Arabia, Kuwait, United Arab Emirates, Oman and Yemen. However, no nest series is known, and only single workers were collected. In COLLINGWOOD (1985), this species appeared under the name *C. desertorum* Forel, 1894, but Forel's species, described from southern Tunisia, is probably a synonym of *C. savignyi* (Agosti & Collingwood, in prep.). For this reason, a formal description will be given later.

DISCUSSION

The wealth of species now known to occur in the Arabian Peninsula includes a relatively large number of new species, about 25 % of the total, which are supposedly endemic. This compares with the Iberian Peninsula where a similar proportion of recorded species are unknown outside Spain or Portugal. It is evident from the many collections from Yemen made by A. van Harten and colleagues, using methods of soil extraction as well as Malaise and light traps, that the present inventory of Arabian species is by no means exhaustive. Leptanillinae and the smaller Myrmicinae continue to produce new records.

In this paper the remarkable number of species in the genus *Monomorium*, 20 % of the total species recorded, is in part due to the comprehensive review of the sub-Saharan species by BOLTON (1987) that gives confidence that any not included in that paper, or in the smaller lists of recorded species from the Middle East, must be new. In other genera with a large number of species such as *Crematogaster*, names are not assignable with confidence without such a review and the same applies even to the larger and more conspicuous ants in such genera as *Camponotus* and *Cataglyphis* where new discoveries continue to be made. It was remarked in the earlier paper that no Dacetinae ants, which include a wealth of African species, have yet been collected in Arabia. There should be some in the more vegetated parts of the southern coastal belt and in the more sheltered valleys.

ACKNOWLEDGEMENTS

Grateful thanks are due to the following who provided this rich material for examination: Prof. William Büttiker, Mr. Michael D. Gallagher and colleagues, Mr. Anthony van Harten and colleagues, Prof. Harold Heatwole, Dr. Barbara Tigar and Dr. Heinrich Wranik. We also thank Mr. Barry Bolton for some guidance on the *Monomorium* species groups and for some very careful editing of the first draft of this paper as an un-named referee. Thanks also are due to Dr. Michael Brancucci for sending various batches of ants collected by Prof. W. Büttiker in Saudi Arabia, Kuwait and Oman. We thank the curators of the following museums for permission to examine their ant collections: Natural History Museum Basel, Zoological Museum Copenhagen, The Natural History Museum, London, Natural History Museum Geneva, Zoological Museum Tel Aviv, The Hope Department of Entomology Museum Oxford, the Kutter collection in the Zoological Museum Lausanne and the American Museum of Natural History. We are grateful for some financial assistance towards the cost of producing this paper to the Pro Entomologia Basel fund, to his Highness the Minister of Natural Heritage and Culture Oman, to the Yemen-German Plant Protection Project and the Avian Research Center, Abu Dhabi. Finally we are indebted to Mr. Anthony Prince for executing all the figure drawings to an acceptable standard for publication.

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New Echinoderm Records for the Gulf including Crown-of-Thorns Starfish, *Acanthaster planci* (Linnaeus), and Their Biogeographical Significance

Andrew R.G. Price and H. Rezai

Abstract: The asteroid *Acanthaster planci* and the echinoid *Asthenosoma varium* are here reported following recent sampling at Larak and Lesser Tonb Islands in Iran. Both echinoderms are new species records for the Gulf, although *A. planci* is probably absent or very uncommon in western and northern parts of the Gulf. The occurrence of *A. planci* in the Gulf extends its known range to all parts of the Indo-West Pacific except the Gulf of Suez. Possible factors accounting for the observed distribution pattern of *A. planci* in the Gulf and adjacent areas are discussed. The presence of the species in the Gulf is of particular biological significance, in view of its tendency elsewhere to form large aggregations that can severely degrade coral reefs.

تسجيلات جديدة لشوكيات الجلد من الخليج العربي متضمنة نجم البحر الشوكي الأكليلي *Acanthaster planci* (Linnaeus) وأهميتها البيوجغرافية

أندرو. ر. ج برايس و هـ. رضائي

خلاصة : يتضمن هذا البحث تسجيل لنجم البحر *Acanthaster planci* وقنفذ البحر *Asthenosoma varium* استناداً لعينات تم جمعها حديثاً من جزر لاراك وطنب الصغرى في إيران. إن هذين الشوكيين يمثلان تسجيلاً جديداً لهذه الأنواع في الخليج، ومن المحتمل أن النوع *A. planci* غير موجود أو نادراً في الأجزاء الغربية والشمالية من الخليج. إن وجود *A. planci* في الخليج يمثل امتداداً لانتشار هذا النوع لكافة أجزاء المنطقة الهندية - غرب المحيط الهادئ ماعداً خليج السويس. كما يناقش هذا البحث العوامل المحتملة التي أدت إلى نمط انتشار *A. planci* في الخليج والمناطق المجاورة. إن وجود هذا النوع في الخليج له أهمية بيولوجية خاصة وذلك بسبب قابليته في المناطق الأخرى على تشكيل تجمعات كبيرة يمكنها أن تخرب الشعاب المرجانية بدرجة كبيرة.

INTRODUCTION

The systematics of echinoderms in the Gulf¹ is well known for Iran (GISLEN 1940, HEDING 1940, MORTENSEN 1940), and Saudi Arabia (PRICE 1981, 1982 a, 1983) where aspects of their ecology have also been studied. Echinoderm studies have been less extensive in southern parts of the Gulf (see PRICE 1981), while in Kuwait research has focused on urchin bioerosion (DOWNING & EL-ZAHR 1987) and population dynamics (DOWNING & ROBERTS 1993). Biogeographic analysis (PRICE 1982 a) has revealed a total of 99 echinoderms species for the Gulf, a fauna that is more limited than in other parts of the Arabian Peninsula.

¹ The term Gulf, rather than Arabian, Persian or Iranian Gulf, is used here in line with recent practice (SHEPPARD et al. 1992).

Despite intensive sampling and extensive observations in the Gulf, the crown-of-thorns starfish, *Acanthaster planci* (Linnaeus, 1758) has not previously been reported for the region. Although the species occurs in the Gulf of Oman (GREEN & KEECH 1986), environmental conditions here are more similar to the adjacent Arabian Sea and Indian Ocean. Hence the Gulf of Oman is not considered part of the Gulf proper (see CLARK & ROWE 1971, PRICE 1982 a).

This paper reports aspects of recent benthic surveys on the Iranian side of the Gulf, during which *A. planci* and *Asthenosoma varium* Grube, 1868 (Echinoidea: Echinothuriidae) were collected and represent new area records for the Gulf.

MATERIALS AND METHODS

During a study of the distribution of shallow-water molluscs on the Iranian side of the Gulf aboard R/V Tadjalli, several echinoderms were encountered and collected by hand using SCUBA by one of us (H.R.). Material was collected from Lesser Tonb Island and Larak Island near the Strait of Hormuz. Water depths at the collection sites ranged from 7 to 22 m, although depths at the south of Lesser Tonb Island can reach 108 m. Specimens were photographed and dried prior to identification using the keys and descriptions of CLARK & ROWE (1971), and also CLARK & COURTMAN-STOCK (1976) for *A. planci*.

Abbreviations

| | |
|------|--------------------------------------------------------------------|
| ARGP | Collection A.R.G. Price, University of Warwick |
| h.d. | Horizontal diameter |
| HR | Collection H. Rezai |
| R | Major radius from the centre of the disc to an arm tip |
| r | Minor radius from the centre of the disc to the disc interradially |
| v.d. | Vertical diameter |

RESULTS

Class Asteroidea

Family Acanthasteridae

Acanthaster planci (Linnaeus, 1758)

Material: Iran: 1 specimen, Lesser Tonb Island, 26°13.98'N 55°09.19'E, 16 m depth, 13.XII.1994, HR; 1 specimen, Larak Island, 26°49.48'N 56°22.06'E, 7 m depth, 9.I.1995, ARGP.

A species of Acanthasteridae with numerous, massive aboral spines up to 27 mm in length. Specimen with 16 arms, R up to ca 155 mm, R/r 1.7-2.2/1. Colour of fresh and dried specimen purplish-brown. Specimen in accordance with description by CLARK & ROWE (1971) and CLARK & COURTMAN-STOCK (1976).

Habitat: At Lesser Tonb Island crown-of-thorns was found on coral rubble and patchily distributed on *Acropora* sp. coral, while at Larak Island the species was actually eating *Acropora* sp.

Distribution: Previously all zoogeographic areas of the Indo-West Pacific including the Red Sea (CLARK & ROWE 1971), although not the Gulf of Suez (PRICE 1982 a), and now newly recorded for the Gulf.

Class Echinoidea
Family Echinothuriidae

Asthenosoma varium Grube, 1868

Material: Iran: 1 specimen, Lesser Tonb Island, 26°13.98'N 55°09.19'E, 22 m depth, 13.XII.1994, ARGP.

H.d. 120 mm, v.d. 60 cm; apical system 15 mm (14 % of h.d.), peristome 35 mm (29 % of h.d.). Colour of fresh and dried specimen orange-purple, the spines yellow-orange near the tips. Specimen matches the description by CLARK & ROWE (1971), although the peristome is damaged.

Habitat: Deep and sheltered waters of Lesser Tonb Island in association with the oyster, *Ostrea cristagalli* (Linnaeus, 1758), wire coral, *Cirrapathes* sp. and the black-lipped pearl oyster, *Pinctada margaritifera* (Linnaeus, 1758).

Distribution: Maldives region and eastern Indian Ocean (CLARK & ROWE 1971), further west in Red Sea including Gulfs of Aqaba and Suez (PRICE 1982 a), and now also in the Gulf as a result of this study.

DISCUSSION

The new area records arising from this study fill in distribution gaps for two echinoderm species (*Acanthaster planci* and *Asthenosoma varium*) in the Indo-Pacific. Prior to this study, the only known localities for *A. varium* within the western Indian Ocean were in the Red Sea according to CLARK & ROWE (1971).

Despite extensive biological observations and surveys of reefs in Saudi Arabia (e.g. BASSON et al. 1977, MCCAIN et al. 1984), Bahrain (VOUSDEN 1988) and Kuwait (Downing, pers. comm.), there appear to be no records of *A. planci* from these parts of the Gulf. It is therefore assumed that the species, although now recorded in Iran, is either absent or is very uncommon in other parts of the Gulf. A partial explanation of this pattern could be that environmental conditions in the Gulf are far from uniform (SHEPPARD et al. 1992). For example, the present study sites in Iran lie within 150 km of the Strait of Hormuz. In this region, salinities (36-37 ppt) are more similar to those nearby in the Gulf of Oman than to areas further inside the Gulf (see SHEPPARD et al. 1992, SHEPPARD 1993, REYNOLDS 1993).

More detailed sampling, especially along the Iranian coast, is needed to determine more precisely the range of *A. planci* in the Gulf. While a detailed hypothesis to explain the observed biogeographic pattern of *A. planci* would be premature, some possible factors acting on *Acanthaster* larvae and/or adults are tentatively suggested. Low winter sea temperatures (< 15 °C: JONES 1986, FADLALLAH et al. 1995) and wide sea temperature ranges (> 20 °C; SHEPPARD et al. 1992) are associated particularly with areas well inside the Gulf, and are a major ecological control in the Gulf. However, temperature effects on *A. planci* involve complex interactions with other factors (JOHNSON & BABCOCK 1994). Salinity, which often exceeds 40 ppt in the Gulf, is another known control of fauna (SHEPPARD et al. 1992) including echinoderms (PRICE 1982 a, b), but this factor alone may not be limiting since *A. planci* occurs in the Red Sea (MOORE 1989, ORMOND et al. 1990), where salinities also can exceed 40 ppt especially in the north (SHEPPARD et al. 1992). Larval transport is also a critical factor influencing *Acanthaster* distribution and abundance (MOORE 1989). Reef/substratum availability (and other factors influencing settlement) must also be important, information for which is very incomplete on the Iranian coast. However, MOORE (1989) suggests that *A. planci* must be capable of traversing great oceanic distances, perhaps

through delaying metamorphosis. Possible biological factors include predation by fish, as shown in Australia and the Red Sea (ORMOND et al. 1990), and competition (CRIMP & BRADDOCK 1993). The present distribution of *A. planci* could equally be due to recent immigration of the species into the Gulf, a factor that should not be overlooked.

Acanthaster planci here newly recorded in the Gulf now extends its known range to all parts the Indo-West Pacific except the Gulf of Suez (CLARK & ROWE 1971, PRICE 1982 a). The Gulf and Gulf of Suez share a number of physical and biological features (PRICE 1982 a). The apparent absence of *A. planci* from the Gulf of Suez and from much of the Gulf, which are both extreme environments, is in accordance with this. In contrast is the widespread occurrence of the species across the remainder of the Indo-West Pacific (CLARK & ROWE 1971), where environmental conditions are generally less extreme.

The occurrence of *A. planci* in the Gulf is also of ecological significance. Live coral is the diet of this starfish, and extensive tracts of dead or degraded reef have been reported in parts of Indo-Pacific following heavy plagues (e.g. ORMOND et al. 1990, JOHNSON & BABCOCK 1994). It appears that *Acanthaster* outbreaks are often localised and a consequence of natural cycles, combined with effects of certain human activities. The latter include pollution and heavy fishing pressure on their natural predators.

ACKNOWLEDGEMENTS

One of us (H.R.) would like to thank crew and colleagues aboard R/V 'Tadjalli' for support during fieldwork.

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A New Weasel Shark of the Genus *Paragaleus* from the Northwestern Indian Ocean and the Arabian Gulf (Carcharhiniformes: Hemigaleidae)

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Abstract: *Paragaleus randalli* n. sp. is described from 14 specimens from the northwestern Indian Ocean and the Arabian Gulf. The new species differs from its congeners by its narrow snout, long mouth, lower anterior teeth mostly oblique-cusped and with well-developed distal cusplets, 165-187 total vertebrae, and colouration. The species has inconspicuous white-edged fins and a pair of narrow dark lines on the underside of its snout.

سمك قرش جديد من الجنس *Paragaleus* (Hemigaleidae : Carcharhiniformes) من الشمال الغربي للمحيط الهندي ومن الخليج العربي

ليونارد كومبانيو، فريدهلم كروب وكنت كاربنتر

خلاصة : تم وصف النوع *Paragaleus randalli* من ١٣ عينة من الشمال الغربي للمحيط الهندي والخليج العربي. هذا النوع الجديد يتميز عن بقية أفراد جنسه بمقدمة رأسه الضيقة، ووجود أنياب جانبية نامية، وكذلك بعدد الفقرات الذي يتراوح بين ١٦٥-١٨٧ فقرة وباللون. لهذا النوع زعانف مخفية بيضاء الحواف وزوج من الخطوط الرفيعة القائمة على الوجه السفلي لمقدمة الرأس.

INTRODUCTION

The carcharhinoid genus *Paragaleus* Budker, 1935 includes three described and valid species of small sharks (Family Hemigaleidae): *Paragaleus pectoralis* (Garman, 1906) from the tropical Eastern Atlantic, *P. leucolomatus* Compagno & Smale, 1985 from South Africa and possibly Madagascar, and *P. tengi* (Chen, 1963) from the Western Pacific. *Paragaleus* was revised by COMPAGNO (1979, 1984, 1988) and by COMPAGNO & SMALE (1985), who noted that there was also an undescribed species of *Paragaleus* from the northwestern Indian Ocean that is closest to *P. leucolomatus* but apparently distinct. This species was recorded from the Arabian (Persian) Gulf as *Hypogaleus hyugaensis* (Family Triakidae) by RANDALL (1986). It is described here as *Paragaleus randalli* n. sp.

TERMINOLOGY AND METHODS

The terminology for external structures (including dentition) and viscera follows COMPAGNO (1970, 1973, 1979, 1988), COMPAGNO & SMALE (1985), and COMPAGNO & SPRINGER (1971).

Measurement terminology is taken from COMPAGNO (1984) who assigned names and abbreviations to measurements often indicated by descriptive phrases (example: snout to upper caudal origin = precaudal length). Vertebral terminology, method of counting and vertebral ratios follow SPRINGER & GARRICK (1964) and COMPAGNO (1970, 1979, 1988), including 'A' ratio (length of penultimate monospondylous precaudal centrum / length of first diplospondylous precaudal centrum $\times 100$) and 'B' ratio (length/width of penultimate monospondylous precaudal centrum $\times 100$).

Abbreviations:

| | |
|--------|--------------------------------------------------------------------------------------------------------------|
| AB | RV "Anton Bruun" station numbers |
| BPBM | Bernice P. Bishop Museum, Honolulu, Hawaii |
| GVF-HK | George Vanderbilt Foundation collection, Hong Kong material, in California Academy of Sciences |
| ISH | Institut für Seefischerei, Hamburg |
| LACM | Los Angeles County Museum of Natural History |
| LJVC | L.J.V. Compagno's personal collection |
| MCZ | Museum of Comparative Zoology, Harvard |
| MNHN | Muséum National d'Histoire Naturelle, Paris |
| PCH | P.C. Heemstra field number, Sri Lanka |
| RUSI | J.L.B. Smith Institute of Ichthyology, Grahamstown, South Africa |
| SMF | Senckenberg Museum, Frankfurt, Germany |
| SNMNH | Saudi Arabian National Museum of Natural History, Riyadh, Saudi Arabia |
| SU | Stanford University, Division of Systematic Biology, collection now housed in California Academy of Sciences |
| SV | Smith-Vaniz field number for FAO collections, Arabian (Persian) Gulf |
| TRR | Tyson R. Roberts field number, Sri Lanka |
| UMMZ | University of Michigan Museum of Zoology |
| USNM | U.S. National Museum of Natural History |

Comparative material examined:

Paragaleus leucolomatus: RUSI-21175, pregnant ♀, 957 mm total length (TOT), southeast of the mouth of Kosi Bay, Natal, South Africa, 20 m depth, 18.V.1984 (holotype of *Paragaleus leucolomatus*).

Paragaleus pectoralis: MCZ 847, immature ♀, 651 mm TOT, from "Aquarial Gardens" (holotype of *Hemigaleus pectoralis* Garman, 1906); LACM-F-168, adult ♂ (jaws only), 860 mm TOT; LJVC-0286, adult ♂ (skeletonised), 885 mm TOT; USNM 196163, fetal ♀, 336 mm TOT, all from Goree, Senegal; USNM 197626, 3 immature ♂♂, 493-540 mm TOT, and 3 immature ♀♀, 490-553 mm TOT, Nigeria; USNM BBC-983, 2 fetal ♂♂, 220-224 mm TOT, Point Guinea, Guinea. Tooth counts, vertebral counts, and measurements were contributed by Prof. J.A.F. Garrick for three additional specimens from Senegal: USNM 196158, ♀, 431 mm TOT; MNHN-36-32, immature ♂, 463 mm TOT (paratype of *Paragaleus gruveli* Budker, 1935); MNHN-38-28, pregnant ♀, 1380 mm TOT (jaws only; holotype of *Paragaleus gruveli* Budker, 1935).

Paragaleus tengi: GVF-HK-87, adult ♂, 881 mm TOT, about 100 miles SW of Hong Kong, South China Sea; GVF-HK-83, adult ♂, 850 mm TOT, south of Hong Kong, South China Sea; UMMZ 177114, adult ♂, 784 mm TOT, East China Sea, Nagasaki, Japan.

Family Hemigaleidae Hasse, 1879 - Weasel sharks

Genus *Paragaleus* Budker, 1935

Paragaleus Budker, 1935. — Bull. Mus. nat. Hist. nat. (2) 7: 107. Type-species: *Paragaleus gruvelli* Budker, 1935 by monotypy; a junior synonym of *Hemigaleus pectoralis* Garman, 1906.

See COMPAGNO (1979, 1984, 1988) and COMPAGNO & SMALE (1985) for definitions of the family Hemigaleidae and the genus *Paragaleus*, and keys to hemigaleid taxa and to *Paragaleus* species.

Paragaleus randalli n. sp. - Slender weasel shark

Holotype: adult ♂, BPBM-21196, 719 mm TOT, 551 mm precaudal length (PRC), Arabian Gulf, Bahrain. — Paratypes: SMF 28109, adult ♂, 685 mm TOT, 527 mm PRC, Arabian Gulf, Kuwait, trawl 28°42.88'N 48°26.30'E-28°44.07'N 48°27.64'E, 24.IV.1995; SNMNH F55, 750 mm TOT, 577 mm PRC, Arabian Gulf, Saudi Arabia, Jubail; ISH 150/65, adolescent ♂, 590 mm TOT, 454 mm PRC, Indian Ocean, Arabian Sea, RV "Meteor" station IOE 229 a/65, 22°01-02'N 68°10-15'E, 7.III.1965; SU 67145, adolescent ♂, 615 mm TOT, 471 mm PRC, Vishakhapatnam (Visagapatam) fish market, Andhra Pradesh State, India, 28.XII.1940; USNM 202652, immature ♀, 384 mm TOT, 288 mm PRC, 08°56'N 76°30'E, off Quilon (Quilam), Kerala State, India; BPBM-19923, adolescent ♂, 598 mm TOT, 453 mm PRC, India. — Additional material (not part of type series): 2 adult ♂♂, 690 mm TOT, 527 mm PRC, and 702 mm TOT, 536 mm PRC, RV "Anton Bruun" station 4B 260A, 26°15'N 56°46'E, Ra's Musandam, Gulf of Oman; adult ♂, 623 mm TOT, 477 mm PRC, and pregnant ♀, 706 mm TOT, 542 mm PRC, FAO Persian Gulf SV, uncatalogued, Arabian Gulf, Bahrain; adolescent ♂, 591 mm TOT, 447 mm PRC, FAO/DANIDA Lemuru station 1-14, 26°31.5-28.6'N 51°05-03.4'E, Arabian Gulf, off Bahrain, 16-18 m depth; PCH 69-195, pregnant ♀, 811 mm TOT, 635 mm PRC, with two term fetuses, a ♂ of 283 mm TOT and a ♀ of 288 mm TOT, Wadge Banks, off Cape Comorin, Tamil Nadu State, India; TRR 70-14, adult ♂, 715 mm TOT, 560 mm PRC, Wadge Banks, Gulf of Mannar, Sri Lanka, 27-28.III.1970.

Diagnosis: A species of *Paragaleus* with a narrowly rounded prenarial snout. Snout with a narrowly rounded tip in lateral view; preoral snout about 1.0-1.4 times mouth width. Mouth long, jaw symphyses extending well anterior to upper labial furrows. Lower jaw relatively deep, prominently visible in lateral view. Longest gill openings about 0.9-1.3 times eye length in adults. Palate and tongue covered by buccopharyngeal denticles. Upper and lower teeth not strongly differentiated, lower anterolateral teeth mostly oblique-cusped and with one or two distal cusplets on five or more rows. Adults with pectoral fins strongly falcate; dorsal and anal fins with deeply concave posterior margins. Total vertebrae 165-187, monospondylous precaudal (MP) centra 38-43, diplospondylous precaudal (DP) centra 51-65, diplospondylous caudal (DC) centra 64-79; caudal vertebrae fewer (38.8-44.3 % of total counts) than precaudals; no 'stutter zone' of alternating long and short centra in region of mono-diplospondylous transition. Underside of prenarial snout with a pair of narrow black lines but no dark patches. No horizontal yellow stripes on sides of body. Dark webs and inconspicuous light posterior margins on most fins but no abruptly white or black tips.

Description: Proportional dimensions as percentages of total length for the holotype and other specimens are given in Table 1. The body shape is shown in Fig. 1.

Head length to 5th gill openings 0.9-1.1 times in pectoral-pelvic space. Head fairly narrow and flattened, roughly rectangular in shape in cross-section at eyes. Outline of head in lateral view undulated dorsally, flat above eyes but convex above gills, slightly convex ventrally along lower jaws and nearly flat beneath gills; in dorsoventral view head anteriorly pointed and posteriorly tapering along branchial region. Preoral snout length 1.0-1.4 times mouth width. Snout tip narrowly rounded in dorsoventral view (Fig. 2), not noticeably indented anterior to nostrils; snout narrowly angular and bluntly pointed in lateral view, straight or slightly convex above and below.

External eye opening or fleshy orbit with prominent posterior notch but no anterior ones; eyes large, length 5.3-8.3 times in head length. Eyes laterally situated on head, but with lower edges

Table 1: Proportional dimensions of *Paragaleus randalli* as percent of total length.

Abbreviations: M. st. = Maturity stage: emb. = embryo or fetus, imm. = immature, adol. = adolescent; T. st. = Type status, holo. = holotype, para. = paratype. Measurement abbreviations follow COMPAGNO (1984).

| | BPBM 21196 | USNM 202652 | ISH 150/65 | FAO/ DAN Lemuru | BPBM 19923 | SU 67145 | SOSC SV UNC | SMF 28109 | AB 4B 260A | AB 4B 260A | SOSC SV UNC | TRR 70-14 | SNM NH F55 | PCH 69-195 |
|--------|---------------|----------------|---------------|-----------------------|---------------|-------------|-------------------|--------------|---------------|---------------|-------------------|--------------|------------------|---------------|
| No. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
| Sex | ♂ | ♀ | ♂ | ♂ | ♂ | ♂ | ♂ | ♂ | ♂ | ♂ | ♀ | ♂ | ♂ | ♀ |
| M. st. | emb. | imm. | adol. | adol. | adol. | adol. | adult | adult | adult | adult | adult | adult | adult | adult |
| T. st. | holo. | para. | para. | | para. | para. | | para. | | | | | para. | |
| TOT | 719 | 384 | 590 | 591 | 598 | 615 | 623 | 685 | 690 | 702 | 706 | 715 | 750 | 811 |
| PRC | 76.6 | 75.0 | 76.9 | 75.6 | 75.8 | 76.6 | 76.6 | 76.9 | 76.4 | 76.4 | 76.8 | 78.3 | 76.9 | 78.3 |
| PRN | 3.2 | 3.6 | 3.2 | 3.2 | 3.2 | 3.1 | 3.9 | 3.2 | 3.6 | 3.8 | 3.4 | 3.4 | 3.5 | 3.7 |
| POR | 6.7 | 6.5 | 6.8 | 6.4 | 6.4 | 6.2 | 7.1 | 7.0 | 6.7 | 7.0 | 6.5 | 6.6 | 6.7 | 6.8 |
| POB | 6.3 | | | 5.8 | 6.0 | 6.3 | 3.5 | 6.4 | 5.9 | 6.6 | 5.9 | 6.0 | 6.4 | |
| PSP | 9.5 | | 10.0 | 9.6 | 9.4 | 9.4 | 10.8 | 10.2 | 9.6 | 9.7 | 9.6 | 9.8 | 9.5 | |
| PGI | 15.2 | | 15.1 | 14.7 | 14.5 | 15.1 | 16.1 | 16.1 | 15.5 | 16.0 | 15.3 | 13.8 | 14.7 | |
| HDL | 20.4 | 20.6 | 19.8 | 19.1 | 19.6 | 18.7 | 20.5 | 20.1 | 20.0 | 21.8 | 19.7 | 19.7 | 20.1 | 19.7 |
| PP1 | 19.2 | | 17.8 | 18.8 | 17.9 | 17.4 | 18.9 | 20.3 | 20.0 | 19.8 | 19.5 | 18.5 | 18.8 | |
| PP2 | 41.4 | | 43.6 | 41.5 | 39.3 | 41.0 | 42.9 | 42.8 | 42.5 | 44.2 | 44.6 | 42.0 | 42.1 | |
| SVL | 43.9 | 44.3 | 45.3 | 43.5 | 42.5 | 43.9 | 43.2 | 45.5 | 43.8 | 47.0 | 46.0 | 43.4 | 43.9 | 46.5 |
| PAL | 60.8 | | 60.0 | 59.4 | 59.4 | 58.5 | 60.2 | 62.9 | 59.1 | 61.3 | 61.5 | 61.7 | 61.9 | |
| PD1 | 26.0 | | 27.1 | 26.4 | 24.7 | 26.2 | 27.1 | 28.0 | 24.8 | 27.2 | 25.9 | 26.2 | 25.9 | |
| PD2 | 56.6 | | 59.2 | 56.5 | 57.0 | 58.0 | 56.8 | 61.2 | 59.6 | 58.4 | 59.5 | 59.9 | 60.5 | |
| IDS | 21.4 | | 22.0 | 20.6 | 22.4 | 22.6 | 20.4 | 21.6 | 23.2 | 20.4 | 21.2 | 24.1 | 23.5 | |
| DCS | 10.0 | | 9.8 | 10.8 | 11.0 | 11.4 | 10.1 | 9.8 | 9.7 | 9.3 | 9.3 | 11.5 | 11.2 | |
| PPS | 19.2 | | 21.2 | 18.8 | 17.4 | 20.3 | 19.4 | 19.4 | 19.6 | 20.7 | 21.4 | 19.9 | 18.9 | |
| PAS | 12.7 | | 12.0 | 12.4 | 12.7 | 12.0 | 12.5 | 13.9 | 11.7 | 12.0 | 12.5 | 15.0 | 14.5 | |
| ACS | 8.5 | | 9.2 | 9.6 | 9.2 | 9.1 | 8.7 | 10.9 | 8.8 | 7.4 | 8.2 | 9.2 | 8.9 | |
| EYL | 2.6 | 3.9 | 2.9 | 2.5 | 2.5 | 2.4 | 2.9 | 2.6 | 2.6 | 2.8 | 2.7 | 2.4 | 2.5 | 2.5 |
| EYH | 1.5 | 2.3 | 1.4 | 1.5 | 1.3 | 1.3 | 1.4 | 1.9 | 1.6 | 1.7 | 1.4 | 1.4 | 1.7 | 1.5 |
| INO | 6.4 | 7.8 | 6.3 | 6.4 | 6.4 | 6.3 | 6.3 | 7.4 | 6.4 | 7.0 | 6.5 | 6.0 | 6.1 | 6.3 |
| NOW | 1.5 | 1.6 | 1.5 | 1.5 | 1.3 | 1.5 | 1.6 | 1.9 | 1.6 | 1.4 | 1.4 | 1.3 | 1.6 | 1.6 |
| INW | 3.2 | 3.6 | 3.4 | 3.4 | 3.3 | 3.3 | 3.5 | 3.5 | 3.2 | 3.7 | 3.3 | 3.1 | 3.3 | 3.2 |
| ANF | 0.7 | | 0.7 | 0.7 | 0.5 | 0.8 | 0.8 | 0.7 | 0.9 | 0.7 | 0.7 | 0.7 | 0.7 | |
| SPL | 0.1 | 0.1 | 0.2 | 0.1 | 0.1 | 0.2 | 0.2 | 0.3 | 0.1 | 0.2 | 0.2 | 0.2 | 0.3 | 0.1 |
| ESL | 1.0 | | 0.8 | 1.0 | 1.0 | 1.1 | 0.8 | 1.0 | 0.9 | 0.9 | 0.8 | 1.0 | 1.1 | |
| MOL | 2.8 | 3.1 | 3.2 | 3.2 | 2.8 | 2.6 | 3.2 | 2.6 | 3.2 | 3.1 | 3.1 | 3.2 | 2.8 | 3.1 |
| MOW | 5.4 | 6.8 | 5.4 | 5.1 | 4.8 | 5.0 | 5.0 | 5.4 | 5.2 | 5.8 | 5.0 | 5.0 | 5.2 | 5.2 |
| ULA | 1.4 | 1.8 | 2.0 | 1.9 | 2.0 | 1.6 | 1.9 | 2.0 | 2.0 | 1.9 | 2.0 | 2.1 | 1.9 | 1.7 |
| LLA | 1.1 | 1.3 | 1.4 | 1.0 | 1.2 | 1.1 | 1.1 | 1.2 | 1.2 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 |
| GS1 | 3.1 | 2.9 | 2.2 | 2.2 | 2.0 | 2.6 | 2.2 | 2.8 | 2.6 | 2.4 | 2.3 | 2.4 | 2.5 | 2.7 |
| GS2 | 3.1 | | 2.2 | 2.7 | 2.5 | 2.6 | 2.4 | 2.8 | 2.6 | 2.4 | 2.5 | 2.5 | 2.4 | |
| GS3 | 2.9 | 3.1 | 2.5 | 3.0 | 2.5 | 2.9 | 2.9 | 2.9 | 2.9 | 2.6 | 2.8 | 2.8 | 2.5 | 3.1 |
| GS4 | 2.9 | | 2.2 | 3.0 | 2.7 | 2.4 | 3.0 | 3.1 | 3.0 | 2.7 | 3.3 | 2.7 | 2.8 | |
| GS5 | 2.4 | 2.6 | 2.2 | 2.4 | 2.3 | 2.3 | 2.6 | 2.2 | 2.3 | 2.4 | 2.5 | 1.8 | 2.1 | 2.7 |
| HDH | 7.9 | | | 8.5 | 7.5 | 8.8 | 7.7 | 6.9 | 8.1 | 10.0 | 8.5 | 8.1 | 6.0 | |
| HDW | 9.2 | | | 8.6 | 8.7 | 8.8 | 9.0 | 8.0 | 8.6 | 11.1 | 8.6 | 8.5 | 6.8 | |
| TRH | 9.9 | 10.4 | | 9.6 | 8.4 | 9.9 | 7.7 | 7.7 | 9.0 | 11.4 | 9.2 | 9.0 | 8.7 | 10.2 |
| TRW | 8.3 | 8.3 | | 6.4 | 8.4 | 7.6 | 6.4 | 6.6 | 7.1 | 9.1 | 6.1 | 6.7 | | 8.3 |
| CPH | 2.4 | | 2.9 | 2.7 | 2.8 | 2.9 | 2.9 | 2.8 | 2.6 | 2.8 | 2.7 | 2.7 | 2.8 | |
| CPW | 1.8 | | 1.9 | 1.9 | 2.2 | 2.3 | 1.9 | 2.2 | 1.9 | 2.3 | 2.3 | 2.1 | 1.9 | |
| GIR | 28.5 | | | 26.2 | 26.8 | 29.3 | 24.2 | 32.8 | 25.4 | 29.9 | 26.2 | 25.9 | 29.9 | |
| P1L | 9.2 | 9.9 | 9.5 | 9.5 | 8.5 | 9.9 | 9.0 | 7.9 | 8.8 | 9.7 | 9.2 | 9.1 | 7.9 | 8.6 |
| P1A | 12.8 | 13.8 | 14.1 | 14.2 | 13.4 | 14.0 | 13.5 | 12.8 | 13.6 | 16.2 | 14.4 | 13.6 | 12.9 | 14.5 |

| | BPBM 21196 | USNM 202652 | ISH 150/65 | FAO/ DAN Lemuru | BPBM 19923 | SU 67145 | SOSC SV UNC | SMF 28109 | AB 4B 260A | AB 4B 260A | SOSC SV UNC | TRR 70-14 | SNM NH F55 | PCH 69-195 |
|-----|---------------|----------------|---------------|-----------------------|---------------|-------------|-------------------|--------------|---------------|---------------|-------------------|--------------|------------------|---------------|
| P1B | 4.2 | | 4.6 | 5.1 | 3.7 | 4.9 | 4.5 | 4.4 | 4.3 | 5.0 | 4.5 | 4.3 | 4.2 | |
| P1H | 12.2 | | | 10.7 | 11.0 | 11.2 | 11.1 | 13.1 | 11.6 | 13.4 | 11.6 | 11.0 | 12.4 | |
| P1I | 5.1 | | 5.1 | 4.4 | 4.8 | 5.2 | 4.3 | 5.1 | 4.9 | 5.3 | 5.1 | 4.6 | 5.9 | |
| P1P | 10.0 | | | 8.3 | 9.2 | 9.1 | 10.1 | 9.2 | 11.4 | 12.5 | 10.9 | 8.8 | 8.9 | |
| P2L | 8.2 | | 8.0 | 8.0 | 8.0 | 8.1 | 8.3 | 8.3 | 8.0 | 8.8 | 8.1 | 8.0 | 8.0 | |
| P2A | 7.1 | 6.5 | 6.8 | 7.1 | 7.0 | 6.7 | 6.7 | 6.7 | 7.0 | 7.7 | 6.8 | 6.6 | 5.3 | 6.7 |
| P2B | 5.4 | | 4.4 | 5.1 | 4.7 | 4.9 | 5.6 | 5.5 | 4.9 | 5.7 | 5.4 | 4.6 | 5.5 | |
| P2H | 5.7 | | 4.9 | 4.9 | 4.2 | 5.2 | 5.8 | 5.4 | 5.7 | 6.0 | 5.2 | 5.0 | 3.6 | |
| P2I | 2.8 | | 3.6 | 2.9 | 3.3 | 3.4 | 2.9 | 3.4 | 3.3 | 2.8 | 2.8 | 3.2 | 2.4 | |
| P2P | 4.7 | | | 3.9 | 3.8 | 4.4 | 4.5 | 5.1 | 4.6 | 4.7 | 4.8 | 4.2 | 4.1 | |
| CLO | 6.8 | | 5.8 | 4.1 | 4.5 | 5.0 | 6.9 | 6.9 | 7.0 | 6.8 | | 8.3 | 6.9 | |
| CLI | 9.5 | | 8.6 | 6.9 | 3.5 | 8.6 | 9.1 | 9.9 | 9.3 | 10.4 | | 9.2 | 9.9 | |
| CLB | 1.1 | | | 0.7 | 0.7 | 1.0 | 1.3 | 1.5 | 1.0 | 1.1 | | 1.1 | 1.3 | |
| D1L | | | 13.1 | 13.2 | 13.4 | 14.1 | 14.9 | 13.3 | 15.1 | 15.0 | 15.0 | 13.8 | 12.4 | |
| D1A | 13.8 | | 12.5 | 13.5 | 13.9 | 13.5 | 14.9 | 12.6 | 13.8 | 14.2 | 13.3 | 13.6 | 11.6 | |
| D1B | 11.4 | 10.4 | 9.7 | 10.2 | 11.2 | 11.1 | 11.7 | 9.9 | 11.6 | 11.3 | 11.9 | 10.9 | 10.0 | 11.0 |
| D1H | 7.9 | 7.8 | 8.0 | 7.6 | 8.0 | 7.3 | 7.4 | 8.6 | 7.8 | 8.5 | 8.1 | 8.0 | 7.7 | 7.4 |
| D1I | | | 3.4 | 3.2 | 2.7 | 3.4 | 3.4 | 3.1 | 3.3 | 3.1 | 3.3 | 3.4 | 3.3 | |
| D1P | | | | 6.9 | 7.7 | 7.8 | 6.7 | 8.5 | 7.4 | 8.8 | 8.1 | 8.8 | 7.1 | |
| D2L | 10.0 | | 11.4 | 9.8 | 10.0 | 10.2 | 10.4 | 9.1 | 10.0 | 11.3 | 10.2 | 9.9 | 9.2 | |
| D2A | 8.9 | | 8.8 | 9.1 | 8.5 | 8.6 | 8.7 | 7.6 | 8.7 | 8.0 | 8.4 | 8.8 | 7.1 | |
| D2B | 7.6 | 7.0 | 8.1 | 7.6 | 7.0 | 7.6 | 7.4 | 6.1 | 7.7 | 8.3 | 7.5 | 7.4 | 6.5 | 6.8 |
| D2H | 5.3 | 4.9 | 5.3 | 4.4 | 4.7 | 4.6 | 5.0 | 5.4 | 4.9 | 5.6 | 5.0 | 4.9 | 5.1 | 5.3 |
| D2I | 2.1 | | 3.2 | 2.4 | 2.3 | 2.3 | 2.6 | 2.9 | 2.8 | 2.6 | 2.7 | 2.4 | 2.7 | |
| D2P | 6.0 | | | 4.7 | 5.0 | 5.2 | 4.8 | 5.0 | 5.7 | 4.7 | 5.4 | 5.3 | 5.3 | |
| ANL | 8.6 | | 8.6 | 8.3 | 8.5 | 10.6 | 8.7 | 7.7 | 9.9 | 9.7 | 8.1 | 8.4 | 8.0 | |
| ANA | 6.7 | | 6.6 | 6.9 | 6.5 | 8.6 | 6.7 | 5.7 | 7.8 | | 5.9 | 6.9 | 5.6 | |
| ANB | 6.4 | 6.5 | 6.3 | 6.1 | 6.2 | 8.0 | 6.1 | 5.4 | 7.5 | 7.0 | 5.8 | 6.3 | 5.3 | 6.4 |
| ANH | 3.5 | 2.9 | 3.2 | 2.7 | 3.2 | 2.9 | 3.0 | 3.6 | 2.9 | 3.6 | 3.4 | 3.1 | 3.3 | 3.1 |
| ANI | 2.6 | | 2.4 | 2.2 | 2.3 | 2.1 | 2.6 | 2.6 | 2.0 | 2.7 | 2.1 | 2.2 | 2.4 | |
| ANP | 3.5 | | 4.2 | 2.9 | 3.3 | 3.9 | 4.2 | 3.8 | 4.1 | | 4.0 | 3.5 | 4.0 | |
| CDM | 23.2 | 25.0 | 23.1 | 24.4 | 23.4 | 23.4 | 23.0 | 21.2 | 22.6 | 23.2 | 22.7 | 22.2 | 21.5 | 21.7 |
| CPV | 8.8 | 8.9 | 9.3 | 8.8 | 8.7 | 8.8 | 8.7 | 9.1 | 8.8 | 9.4 | 8.9 | 8.3 | 8.3 | 8.5 |
| CPL | 2.9 | 2.6 | 2.7 | 2.4 | 3.0 | 1.8 | 2.7 | 3.8 | 3.0 | 3.8 | 3.1 | 2.5 | 2.4 | 2.7 |
| CPU | 10.3 | 12.5 | 9.5 | 10.0 | 9.4 | 8.9 | 10.6 | 9.5 | 10.6 | 10.7 | 10.1 | 9.7 | 10.1 | 9.7 |
| CST | 3.5 | 3.4 | 3.6 | 3.6 | 3.2 | 3.6 | 3.2 | 3.4 | 3.0 | 3.8 | 2.7 | 3.1 | 3.5 | 3.2 |
| CTR | 6.7 | 6.0 | 5.8 | 5.6 | 5.7 | 5.4 | 7.5 | 6.7 | 6.8 | 6.7 | 6.1 | 5.5 | 5.7 | 5.3 |
| CTL | 8.2 | 8.6 | 8.1 | 8.1 | 6.7 | 8.0 | 8.0 | 8.0 | 8.1 | 9.0 | 7.6 | 7.6 | 8.0 | 7.3 |
| CFL | 6.7 | | | 6.6 | 6.7 | 7.5 | 6.7 | 6.6 | 6.7 | 7.0 | 6.8 | 6.3 | 6.4 | |

just reaching horizontal head rim in dorsal view, subocular ridges absent. Nictitating lower eyelids internal, with deep subocular pouches and secondary lower eyelids fused to upper eyelids.

Spiracles small but prominent and noticeably larger than lateral line and ampullar pores, length about 12-30 times in eye length, located about 0.4 eye lengths behind and about opposite posterior eye notch. First three or four gill openings equally wide, fifth about 0.7-0.9 of width of third; width of third about 6.2-7.8 in head length and 0.8-1.3 times eye length. Edges of gill openings concave, not lobed, gill filaments not visible from outside. Upper ends of gill openings about opposite posterior eye notches. Gill-raker papillae absent from gill arches.

Nostrils with oval incurrent apertures, prominent but triangular anterior nasal flaps with broad pointed tips, low mesonarial flaps, small oval excurrent apertures, and small posterior nasal flaps.

Nostrils well in front of mouth, about 1.7 times farther from snout tip than from eyes. Nostril width 2.0-2.4 in internarial width, 1.5-2.5 in eye length, and 0.8-1.3 in third gill-opening.

Mouth broadly arched and moderately large (Fig. 2), width 3.0-4.1 in head length and 0.7 of head width at mouth corners; mouth length 1.6-2.2 in mouth width. Tongue large, flat and narrowly rounded, filling floor of mouth, and with a notched, bilobate anterior tip. Maxillary valve narrow, width less than one quarter of eye diameter, highly papillose. No large buccal papillae on floor or roof of mouth behind maxillary valve, but with regular lines of tiny papillae between gill arches and behind tongue. Palate, tongue and gill arches covered with buccopharyngeal denticles, naked on floor of mouth between gill arches. Labial furrows long, uppers 1.3-1.9 times as long as lowers, anterior ends of uppers under last half of eye length and reaching about halfway from level of mouth corners to symphysis of upper jaw. Labial cartilages large.

Teeth relatively few, in 28-30/28-33 rows, 1-2/2-5 series functional. Teeth not arranged in diagonal files, no toothless spaces at symphysis. Teeth highly differentiated in upper and lower jaws and along jaws, tooth row groups include medials (M), symphyseals (S), anteriors (A), antero-laterals (AL), and posteriors (P). The tooth formula is:

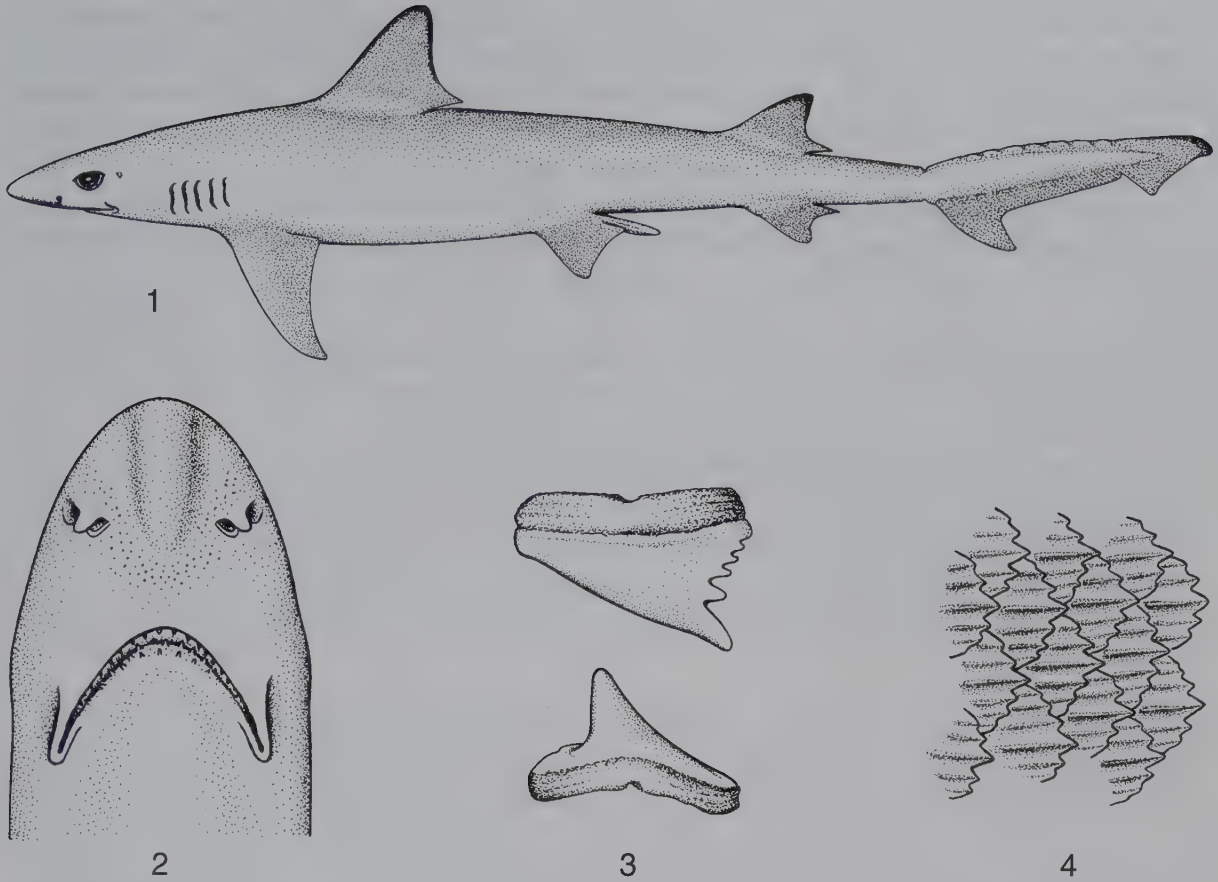
| | | | | |
|------|-------------------------------------|-------|----|-------------------|
| Left | P3-4 L7-9 A1 S1 M1 S1 A1 L7-10 P3-5 | Right | or | 11-13- -3- -13-14 |
| | P5-7 AL6-8 S1 M1 S1 AL6-8 P5-7 | | | 12-15- -3- -13-15 |

Upper teeth broader, flatter, and with broader, more oblique, shorter cusps (except posteriors), slightly higher crown feet, and less developed basal ledges than lowers; both are blade-like, with mesial and distal cutting edges, unnotched mesial edges, and distal cusplets, though cusplets may be absent on the first few rows of lower teeth. Upper medials very high, narrow and erect-cusped, narrow and small, spike-like symmetrical teeth with one or two low cusplets on each side. Upper

Table 2: Tooth counts of *Paragaleus randalli*.

| | L | Upper | | | | | | | | R | L | Lower | | | | | | R |
|-------------|---|-------|---|---|---|---|---|----|---|---|---|-------|---|---|---|---|--|---|
| | P | L | A | S | M | S | A | L | P | P | L | S | M | S | L | P | | |
| USNM 202652 | 4 | 7 | 1 | 1 | 1 | 1 | 1 | 7 | 5 | 6 | 6 | 1 | 1 | 1 | 6 | 7 | | |
| ISH 150/65 | 4 | 8 | 1 | 1 | 1 | 1 | 1 | 8 | 4 | 6 | 7 | 1 | 1 | 1 | 7 | 7 | | |
| SU 67145 | 4 | 8 | 1 | 1 | 1 | 1 | 1 | 8 | 4 | 7 | 7 | 1 | 1 | 1 | 6 | 7 | | |
| AB 4B 260A | 4 | 8 | 1 | 1 | 1 | 1 | 1 | 8 | 4 | 7 | 7 | 1 | 1 | 1 | 7 | 7 | | |
| AB 4B 260A | 4 | 6 | 1 | 1 | 1 | 1 | 1 | 10 | 3 | 7 | 7 | 1 | 1 | 1 | 7 | 7 | | |
| TRR 70-14 | 4 | 8 | 1 | 1 | 1 | 1 | 1 | 8 | 4 | 6 | 7 | 1 | 1 | 1 | 7 | 6 | | |
| PCH 69-195 | 4 | 8 | 1 | 1 | 1 | 1 | 1 | 8 | 4 | 7 | 8 | 1 | 1 | 1 | 8 | 7 | | |

| | Upper | | | Lower | | | Totals | | | Series | | | |
|-------------|-------|---|----|-------|---|----|--------|----|----|--------|---|---|---|
| | L | M | R | L | M | R | U | L | T | U | U | L | L |
| USNM 202652 | 13 | 1 | 14 | 13 | 1 | 14 | 28 | 28 | 56 | 1 | 2 | 2 | 3 |
| ISH 150/65 | 14 | 1 | 14 | 14 | 1 | 15 | 29 | 30 | 59 | 1 | 2 | 2 | 2 |
| SU 67145 | 14 | 1 | 14 | 15 | 1 | 14 | 29 | 30 | 59 | 1 | 2 | 2 | 5 |
| AB 4B 260A | 14 | 1 | 14 | 15 | 1 | 15 | 29 | 31 | 60 | 1 | 2 | 2 | 3 |
| AB 4B 260A | 12 | 1 | 15 | 15 | 1 | 15 | 28 | 31 | 59 | 1 | 2 | 3 | 4 |
| TRR 70-14 | 14 | 1 | 14 | 14 | 1 | 14 | 29 | 29 | 58 | 1 | 2 | 2 | 3 |
| PCH 69-195 | 14 | 1 | 14 | 16 | 1 | 16 | 29 | 33 | 62 | 1 | 2 | 2 | 4 |



Figs 1-4: *Paragaleus randalli* n. sp.: 1, habitus of adult ♂, 750 mm TOT, SNMNH F55; 2, same specimen, underside of head; 3, upper and lower anterolateral tooth, SMF 28109; 4, same specimen, dermal denticles from subdorsal region (drawings by G. Eder).

symphyseals are broader and larger than medials though narrow, not blade-like, and asymmetrical, with semi-oblique long cusps, one to three distal cusplets and one mesial one. The single row of upper anteriors have oblique high cusps and are larger than the symphyseals and smaller and narrower than the adjacent laterals; these are compressed, blade-like teeth with one to three low mesial cusplets and three to four prominent short distal cusplets. Upper laterals are more blade-like than the anteriors and with an oblique prominent cusp, no mesial cusplets, and one to five distal cusplets and a distal blade (Fig. 3); distally the laterals get smaller, thicker-cusped, and have a more convex mesial edge and fewer cusplets. Upper posteriors are low-crowned keel-like teeth without cusps or cusplets but with a broad convex edge.

Lower medials are small, erect and straight-cusped, narrow symmetrical teeth with arched roots and crown feet, and with a pair of cusplets present or absent. Lower symphyseals larger than medials and similar in shape, but with broader crown feet, higher cusps, and with a distal cusplet present or absent. Lower anterolaterals are large narrow-cusped teeth with broad low crown feet and roots, and concave to convex mesial edges and concave distal edges. The first row of anterolaterals is somewhat narrower-footed than more distal rows and is apparently an incipient and weakly differentiated anterior. Anterolateral teeth decrease in size distally, with cusps becoming considerably lower and more oblique; the first one to three rows may have distal blades only and semi-erect or erect cusps but teeth in more distal rows have one or two cusplets, oblique cusps and

a blade; there is variation in the numbers of rows with distal cusplets, and all rows of anterolateral teeth can have them. Lower posteriors similar to uppers but smaller and lower-crowned. All teeth with broad transverse grooves and prominent centrolingual foramen on linguobasal attachment surface of roots. Tooth histological type orthodont, with a definite pulp cavity, crown formed of orthodentine and enameloid, and osteodentine confined to roots.

Body elongate and slender (Fig. 1), trunk vertically oval in section at first dorsal base, length of trunk from 5th gill openings to vent 1.1-1.4 times head length. A low interdorsal ridge on midline of back between dorsal fins but no postdorsal ridge; a low predorsal ridge extending from dorsal fin to about opposite 5th gill openings; lateral ridges absent from body. Caudal peduncle slender, cylindrical-subquadrate, tapering and without lateral keels; height of caudal peduncle at 2nd dorsal insertion 1.1-1.4 times its width there and 2.3-3.2 times in dorsocaudal length. Upper and lower precaudal pits present, both transverse and crescentic.

Lateral trunk denticles of adults, adolescents and juveniles with flat, oval crowns about as wide or slightly wider than long (Fig. 4). Crown mostly with five prominent longitudinal ridges that extend the entire length of the crown onto the cusps (with the medial ridge strongest and the distalmost lateral ridges lowest), a short but strong medial cusp that is much shorter than the rest of the crown, and two pairs of much shorter lateral cusps with the distalmost lowest. Denticle crowns closely imbricated, not wide-spaced. Denticle pedicels short and thick, but elevating crowns well above skin.

Pectoral fins narrow and falcate, with broadly convex anterior margins, narrowly rounded to acutely pointed apices, broadly concave posterior margins, broadly rounded free rear tips, convex inner margins, and narrow bases. Pectoral length from origin to rear tip 1.4-1.7 times in anterior margin length. Pectorals subequal or slightly larger in area than first dorsal fin. Origins of pectorals about under interspace between third and fourth gill openings or under fourth gill opening. Apex of pectoral posterior to its free rear tip when fin is elevated and appressed to body.

Pelvic fins triangular and weakly falcate; length of anterior margins 0.46-0.55 of pectoral anterior margins; area somewhat greater than anal fin. Pelvic anterior margins slightly convex, apices narrowly rounded or bluntly pointed, posterior margins broadly concave, free rear tips bluntly or acutely pointed, inner margins straight to concave; inner margins, posterior margins, and rear tips forming a broad triangle. Claspers of adult males elongated, extending behind pelvic rear tips by over the pelvic inner margin length but ending well anterior to anal fin origin. Claspers with small posteriorly-pointed denticles on ventrolateral surface, naked on dorsomedial surface. Clasper glans on posterior half of clasper; glans has large cover rhipidion concealing other clasper structures, a small pseudosiphon opposite the anterior third of the cover rhipidion and not connected to its base by a groove; a very low rhipidion that extends the length of the glans and is entirely concealed by the cover rhipidion; a large mesorhipidion that extends about three-fourths of the length of the glans towards the posterior clasper tip; and a small pseudopera medial to and opposite the midlength of the mesorhipidion.

First dorsal fin high, apically narrow and weakly falcate, with basally concave and distally convex anterior margin, narrowly rounded or subangular apex, broadly notched posterior margin, acutely pointed and slender free rear tip, and slightly concave or straight inner margin. First dorsal origin about opposite rear half of pectoral inner margins, midpoint of base 1.5 times closer to pectoral insertions than pelvic origins, and insertion and free rear tip well anterior to pelvic origins. Posterior margin slanting ventrally and abruptly posteriorly from apex, insertion about opposite or slightly posterior to level of dorsal apex. Base 1.7-2.3 times in interdorsal space and 1.9-2.4 in dorsal caudal margin, height 1.2-1.6 times in base, and inner margin 2.1-2.7 times in height and 2.9-4.2 times in base.

Second dorsal fin high, apically narrow but hardly falcate, height 0.6-0.7 times first dorsal height, base 0.6-0.8 times first dorsal base. Anterior margin concave basally and distally convex, apex narrowly rounded or bluntly pointed, posterior margin broadly convex, free rear tip acutely pointed, and inner margin slightly concave. Second dorsal origin well behind pelvic insertions by a space somewhat greater than the pelvic fin lengths and free rear tip extending to somewhat anterior to anal free rear tip but far in front of upper caudal origin. Posterior margin slanting ventrally and abruptly posteroventrally from apex, insertion below dorsal apex. Base 1.1-1.6 times in dorsal-caudal space, height 1.3-1.7 times in base, and inner margin 1.6-2.5 times in height and 2.8-3.7 times in base.

Anal fin high, apically narrow, and semi-falcate, height 0.6-0.7 times second dorsal height, base length 0.8-1.0 times second dorsal base. Anterior margin concave basally and distally convex, apex bluntly pointed or rounded, posterior margin broadly concave, free rear tip acutely pointed, and inner margin nearly straight. Anal base expanded anteriorly as short preanal ridges less than half length of rest of base, anal origin slightly behind second dorsal origin, anal insertion slightly behind second dorsal insertion, and free rear tip well in front of lower caudal origin. Anal posterior margin arcing posterodorsally, anal insertion above or slightly behind apex. Base 1.1-1.6 times in anal-caudal space, height 1.7-2.7 times in base, and inner margin 1.2-1.6 times in height and 2.4-3.8 times in base.

Caudal fin narrow-lobed and asymmetrical, with short terminal lobe and prominent, bluntly or acutely falcate ventral lobe. Length of dorsal margin 3.0-3.6 times in precaudal length, preventral caudal margin 2.5-2.8 times in dorsal caudal margin, terminal lobe from caudal tip to subterminal notch about 2.6-3.5 in dorsal caudal margin, subterminal margin length 1.5-2.4 times in terminal margin. Dorsal caudal margin proximally and distally convex, and mesially nearly straight, with prominent lateral undulations. Preventral margin broadly convex, tip of ventral caudal lobe pointed, lower postventral margin concave or nearly straight, upper postventral margin nearly straight, notch between postventral margins forming approximately a 90° angle, subterminal notch a narrow, deep slot, subterminal margin straight or slightly concave, and terminal margin concave, lobe formed by these margins narrowly rounded, and tip of tail pointed.

Counts of total vertebral centra (TC) 165-187, monospondylous precaudal (MP) centra 38-43, diplospondylous precaudal (DP) centra 51-65, diplospondylous caudal (DC) centra 64-79; MP centra 22.9-25.1 %, DP centra 30.5-38.2 %, and DC centra 38.8-44.3 % of TC centra. Ratios of DP/MP centra 1.2-1.7, DC/MP centra 1.6-1.9, 'A' ratio 109-157, 'B' ratio 75-100 (see Table 3). Transition between MP and DP centra over pelvic bases and opposite or just behind pelvic girdle. Last few MP centra before MP-DP transition moderately enlarged, not forming a 'stutter zone' of alternating long and short centra.

Intestinal valve of conicospiral type with four or five anteriorly elongated turns.

Colour in preservative medium grey-brown on dorsal surface of head, trunk, and tail, lighter on sides; whitish on underside from snout to ventral caudal origin; no yellow lines or horizontal stripes on flanks. Underside of prenarial snout with a pair of longitudinal black lines, sometimes an indistinct medial line between. All fin webs mostly darker grey-brown, including undersides of pectoral and pelvic fins, bases and posterior margins lighter but no abruptly white tips. Apices of dorsal fins sometimes dark or blackish but no abruptly black tips.

Derivatio nominis: The species name has been selected in honour of Dr. John E. Randall, Bishop Museum, Oahu, Hawaii, who has collected this species in the Arabian Gulf.

Reproduction, size and maturation: development viviparous, with an entire yolk-sac placenta. A 706 mm TOT pregnant female had a 146 mm male fetus in one uterus while an 811 mm female

Table 3: Vertebral counts and ratios of *Paragaleus randalli*. n = 12.

| | BPBM 21196 | USNM 202652 | ISH 150/65 | Lemuru 1-14 | BPBM 19923 | SU 67145 | AB 4B 260A | AB 4B 260A | TRR 70-14 | PCH 69-195 | PCH 69-195 | PCH 69-195 | Mean | SD | CV | Min. | Max. |
|-----------|---------------|----------------|---------------|----------------|---------------|-------------|---------------|---------------|--------------|---------------|---------------|---------------|-------|------|------|-------|-------|
| No. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | | | | | |
| Sex | ♂ | ♀ | ♂ | ♂ | ♂ | ♂ | ♂ | ♂ | ♂ | ♀ | ♀ | ♂ | | | | | |
| M. st. | adult | imm. | adol. | adol. | adol. | adol. | adult | adult | adult | emb. | ad., pr. | emb. | | | | | |
| TL | 719 | 378 | 590 | 591 | 598 | 615 | 685 | 695 | 715 | 288 | 811 | 283 | | | | | |
| MP | 42 | 42 | 42 | 42 | 39 | 41 | 43 | 41 | 42 | 42 | 42 | 38 | 41.3 | 1.4 | 3.3 | 38 | 43 |
| DP | 51 | 59 | 60 | 59 | 59 | 58 | 65 | 59 | 59 | 58 | 60 | 63 | 59.2 | 3.2 | 5.3 | 51 | 65 |
| DC | 74 | 74 | 69 | 78 | 72 | 73 | 79 | 75 | 71 | 68 | 74 | 64 | 72.6 | 4.0 | 5.5 | 64 | 79 |
| PC | 93 | 101 | 102 | 101 | 98 | 99 | 108 | 100 | 101 | 100 | 102 | 101 | 100.5 | 3.3 | 3.2 | 93 | 108 |
| TC | 167 | 175 | 171 | 179 | 170 | 172 | 187 | 175 | 172 | 168 | 176 | 165 | 173.1 | 5.7 | 3.3 | 165 | 187 |
| % MP | 25.1 | 24.0 | 24.6 | 23.5 | 22.9 | 23.8 | 23.0 | 23.4 | 24.4 | 25.0 | 23.9 | 23.0 | 23.9 | 0.7 | 3.1 | 22.9 | 25.1 |
| % DP | 30.5 | 33.7 | 35.1 | 33.0 | 34.7 | 33.7 | 34.8 | 33.7 | 34.3 | 34.5 | 34.1 | 38.2 | 34.2 | 1.7 | 4.8 | 30.5 | 38.2 |
| % DC | 44.3 | 42.3 | 40.4 | 43.6 | 42.4 | 42.4 | 42.2 | 42.9 | 41.3 | 40.5 | 42.0 | 38.8 | 41.9 | 1.4 | 3.4 | 38.8 | 44.3 |
| % PC | 55.7 | 57.7 | 59.6 | 56.4 | 57.6 | 57.6 | 57.8 | 57.1 | 58.7 | 59.5 | 58.0 | 61.2 | 58.1 | 1.4 | 2.5 | 55.7 | 61.2 |
| DP/MP | 1.2 | 1.4 | 1.4 | 1.4 | 1.5 | 1.4 | 1.5 | 1.4 | 1.4 | 1.4 | 1.4 | 1.7 | 1.4 | 0.1 | 6.9 | 1.2 | 1.7 |
| DC/MP | 1.8 | 1.8 | 1.6 | 1.9 | 1.8 | 1.8 | 1.8 | 1.8 | 1.7 | 1.6 | 1.8 | 1.7 | 1.8 | 0.1 | 4.4 | 1.6 | 1.9 |
| LM | 5.1 | 2.8 | 4.7 | 5.0 | 6.3 | 5.0 | 5.7 | 5.9 | 5.9 | 1.9 | 6.9 | 2.2 | | | | | |
| LD | 3.6 | 2.0 | 4.0 | 4.1 | 4.6 | 4.2 | 4.6 | 4.0 | 5.4 | 1.5 | 5.5 | 1.4 | | | | | |
| HM | 6.8 | 2.9 | 4.9 | 5.4 | 6.3 | 5.2 | 5.9 | 6.4 | 6.5 | 2.3 | 8.2 | 2.5 | | | | | |
| 'A' ratio | 141.7 | 140.0 | 117.5 | 122.0 | 137.0 | 119.0 | 123.9 | 147.5 | 109.3 | 126.7 | 125.5 | 157.1 | 130.6 | 13.4 | 10.3 | 109.3 | 157.1 |
| 'B' ratio | 75.0 | 96.6 | 95.9 | 92.6 | 100.0 | 96.2 | 96.6 | 92.2 | 90.8 | 82.6 | 84.1 | 88.0 | 90.9 | 7.0 | 7.7 | 75.0 | 100.0 |

had two term fetuses (one per uterus) 283-292 mm long. Males examined were adolescent at 590-615 mm (n = 4) and adult at 623-750 mm (n = 7).

Affinities: *Paragaleus randalli* differs from all other species of *Paragaleus* in its less differentiated upper and lower teeth, in its lower anterolateral teeth with mesial cutting edges, mostly oblique cusps, and distal cusplets and blades; in its narrowly rounded head and snout in dorso-ventral view; in having a pair of black lines on the underside of its snout tip; and possibly in its smaller size (adults between 623 and 811 mm, vs 784-1380 mm in other species). *P. tengi* resembles *P. randalli* in mouth and fin shape, but has a broader head and snout, 30-34 fewer vertebrae, and a stutter zone of alternating long and short MP centra. *Paragaleus pectoralis* has a shorter mouth with upper labial furrows about reaching the upper jaw symphysis, a flatter lower jaw, 15-30 fewer vertebrae (averages about 30 fewer vertebrae), stutter zone of alternating long and short MP centra, and horizontal yellow lines on the sides of the body. *P. leucolomatus* also has high vertebral counts (180 total vs 165-187 in *P. randalli*) but differs in its broader, shorter, more bluntly rounded snout; naked tongue and palate; lower anterolateral teeth mostly with erect cusps, mesial and distal shoulders and notched mesial edges on more mesial rows, and without distal cusplets; more falcate fins with more deeply concave posterior margins on its dorsal and anal fins; black blotches rather than lines on the underside of its snout tip; fins with conspicuous white edges; and possibly more reduced spiracles that are hardly distinguishable from ampullal or lateral-line pores. FOURMANOIR's (1961) Madagascar *Paragaleus* differs from adult *P. randalli* in having a blunter, more rounded snout, a lower mouth, and more erect lower anterior teeth.

Distribution: As currently known *P. randalli* is confined to the northern Indian Ocean and occurs in the Arabian Gulf, the Gulf of Oman, the west and south coast of India (west of the Gulf of Kutch, Gujarat; off Quilon, Kerala; and off Cape Comorin, Tamil Nadu), Sri Lanka, and the northeast coast of India (Vishakhapatnam, Andhra Pradesh).

ACKNOWLEDGEMENTS

We would like to thank the following individuals for supplying specimens and information: Dr. Shelton P. Applegate (Instituto de Geologia, Ciudad Universitaria, Mexico City), Dr. Tyson R. Roberts (California Academy of Sciences, San Francisco), Mrs. Myvanwy M. Dick (Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts), Dr. Phillip C. Heemstra (J.L.B. Smith Institute of Ichthyology), Prof. J.A.F. Garrick (formerly of the Department of Zoology, Victoria University, Wellington, New Zealand), Dr. Reeve M. Bailey (University of Michigan Museum of Zoology, Ann Arbor), Dr. John E. Randall (Bernice P. Bishop Museum, Honolulu, Hawaii), and Drs. Dr. Leslie W. Knapp, Stanley H. Weitzman and Victor G. Springer (Division of Fishes, U.S. National Museum of Natural History). Dr. Sulaiman Al-Matar (Kuwait Institute of Scientific Research, Kuwait) is gratefully acknowledged for allowing two of us (FK and KEC) to participate in an experimental trawl in Kuwaiti waters during which one of the paratypes was caught. We are grateful Mr. Mubarak Al-Marri (Jubail Marine Wildlife Sanctuary, Jubail, Saudi Arabia), Mr. Uwe Zajonz and Mr. Horst Zetzsche (Senckenberg Museum, Frankfurt, Germany) for their assistance in the field and in the laboratory. The senior author's work was funded by a South African Foundation for Research Development core grant to the South African Museum.

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Four New Records of Fishes from the Red Sea

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Abstract: Four species of bony fishes are recorded for the first time from the Red Sea: *Myripristis chryseres* (Holocentridae), *Pterygotrigla hemisticta* (Triglidae), *Bodianus leucostictus* (Labridae) and *Thunnus alalunga* (Scombridae). They were collected along the Jordanian coastline at the northern tip of the Gulf of Aqaba and specimens were deposited at the Marine Science Station, Aqaba. The species are briefly diagnosed and illustrated.

أربع تسجيلات لأنواع جديدة من أسماك البحر الأحمر

معروف خلف وأحمد م. الديسي وفريدهلم كروب

خلاصة: لقد تم في البحر الأحمر تسجيل أربعة أنواع جديدة من الأسماك العظمية وذلك للمرة الأولى وهي: *Myripristis chryseres* (Holocentridae)، *Pterygotrigla hemisticta* (Triglidae)، *Bodianus leucostictus* (Labridae)، *Thunnus alalunga* (Scombridae). جمعت هذه الأنواع على طول خط الساحل الأردني في الرأس الشمالي لخليج العقبة وأودعت في معهد علوم البحار في العقبة. وقد تم باختصار وضعها وتصويرها.

INTRODUCTION

The Red Sea ichthyofauna is quite well known compared to other parts of the tropical Indo-Pacific. GOREN & DOR (1994) recorded 1248 fish species from this semi-enclosed northern extension of the Indian Ocean. RANDALL (1994) added another 22 new records. Together with additional records and new taxa published since 1994, more than 1270 fish species are known from the Red Sea.

The Marine Science Station in Aqaba has been compiling an inventory of the fish fauna of the Jordanian Red Sea since 1993. Fishes were collected by hand nets, gill nets, traps, hook and line and quinaldine. Additional specimens were obtained from local fishermen. Immediately after capture the fishes were photographed, and meristic counts and morphometric measurements were taken. Based on this systematic ichthyological survey of the Jordanian coast by the senior author, four additional species which have not been recorded previously, are reported here. The diagnoses and figures for the new records presented are based on specimens deposited at the Marine Science Station in Aqaba.

Abbreviations:

| | |
|------|------------------------------|
| FL | fork length |
| HL | head length |
| MSSA | Marine Science Station Aqaba |
| SL | standard length |

Family **Holocentridae***Myripristis chryseres* Jordan & Evermann, 1903 (Plate 1)

Myripristis chryseres Jordan & Evermann, 1903: 171. Type locality: Hilo, Hawaii.

Material: 1 spm., SL 162 mm, Aqaba, in front of hotels, below 50 m depth, caught by gill net, VI.1994, MSSA 32-8/1.

Diagnosis: Dorsal rays X/I, 14; anal rays IV, 12; pectoral rays 15; lateral line scales 33; gill rakers on first gill arch 13 + 26. Body depth 2.31, head length 2.87 in SL; snout length 5.28, postorbital length 2.44, interorbital width 4.56, and eye diameter 2.59 in HL; 3rd dorsal spine longest, 1.88 in HL; anal fin 1.85, pelvic fin 1.55 and pectoral fin 1.38 in HL. No scales on inner side of pectoral base. Colour of fresh specimen light red on body, edges of scales darker red; head red; black area on opercular membrane extending below opercular spine; spines of 1st dorsal fin red, membranes yellowish-orange with red tips; rays of second dorsal and anal fins yellow with red bases and tips, membranes transparent and without pigmentation; caudal fin yellow, partly mottled with red, edges red; anterior border of anal and pelvic spine whitish, first three pelvic rays yellow, others red; pectoral fin red (Plate 1).

Remarks: The species has previously been recorded from the Hawaiian Islands, Japan, Samoa, Sri Lanka and southern Africa, where it usually occurs at depths below 30 m (RANDALL & HEEMSTRA 1986). The present record, from the northern tip of the Gulf of Aqaba, is a significant extension of its known range.

Family **Triglidae***Pterygotrigla hemisticta* (Temminck & Schlegel, 1843) (Plate 2)

Trigla hemisticta Temminck & Schlegel, 1843: 36. Type locality: Nagasaki, Japan.

Material: 1 spm., SL 125 mm, opposite hotel beach, caught by hand line at a depth below 150 m, XI.1994, MSSA 244.

Diagnosis: Base of first dorsal fin covered by broad horny plates, no plates at base of second dorsal fin, dorsal rays VII, 13; anal rays I, 11; pectoral rays 14, of which the three lowermost are without membrane; gill rakers on first gill arch 4 + 18, including three rudimentary rakers. Opercular spine very long, 3.73 in HL, extending beyond tip of cleithral spine. Body depth 3.73 in SL; head length 2.58 in SL; snout length 2.43 in HL; pectoral fin length 1.27, lowermost free pectoral ray 1.73, second free pectoral ray from below 1.42, and third free pectoral ray from below 1.18 in HL. Colour of fresh specimen light red on head and flanks above mid-line of body with several irregular rows of dark brown spots beginning below the eye and extending onto the caudal peduncle, whitish below mid-line of body; spines of first dorsal fin light red and mottled with brown, spines and membranes with dark spots which fuse and form a large blotch in the posterior part; second dorsal fin with series of dark spots; upper membranous part of pectoral fin with irregular, horizontal, whitish, reddish and black stripes; free pectoral rays mottled with red; other fins without colouration (Plate 2).

Remarks: We tentatively place the specimen from Aqaba in *P. hemisticta*, although it differs slightly in morphology and colouration from other specimens of this species and might represent an undescribed taxon. *Pterygotrigla hemisticta* has previously been recorded from the Western



Plates 1-4: 1, *Myripristis chryseres* (MSSA 32-8/1); 2, *Pterygotrigla hemisticta* (MSSA 244); 3, *Bodianus leucostictus* (MSSA 35-33/1); 4, *Thunnus alalunga* (MSSA 62-5/1).

Central Pacific, Japan, the Eastern Indian Ocean and south-western India, where it inhabits mud bottoms down to depths below 200 m (RICHARDS 1984). This record from the Gulf of Aqaba is an important range extension.

Family Labridae

Bodianus leucostictus (Bennett, 1831) (Plate 3)

Labrus leucostictus Bennett, 1831: 166. Type locality: Mauritius.

Material: 1 spm., SL 195 mm, Aqaba, in front of hotel beach, below 100 m depth, caught by gill net, VII.1994, MSSA 35-33/1.

Diagnosis: Dorsal fin continuous, dorsal rays XII, 10; anal rays III, 12; pectoral rays 16; gill rakers on first gill arch 6 + 11; lateral line continuous, smoothly curved, with 30 pored scales. Caudal fin truncate, rounded at edges. A large, curved canine at rear on each side of upper jaw. Body depth 2.67, head length 2.71 in SL; snout length 2.67, interorbital width 4.8 in HL. Colouration of fresh specimen whitish-orange on body, becoming lighter ventrally, with four irregular red and black longitudinal lines, the upper three of which originate at the hind margin of the eye and extend to the caudal fin base; irregular rows of fine red and black spots between and below these lines; series of larger black spots at dorsal fin base (Plate 3).

Remarks: This species has previously been recorded from southern Japan, Mauritius, Réunion, South Africa, Mozambique and Somalia, where it occurs at depths of about 50 m and below (RANDALL 1986).

Family Scombridae

Thunnus alalunga (Bonnaterre, 1788) (Plate 4)

Scomber alalunga Bonnaterre, 1788: 139. Type locality: Sardinia.

Material: 1 spm., SL 1000 mm, FL 1070 mm, Aqaba, in front of phosphate port, caught by gill net, III.1995, MSSA 62-5/1.

Diagnosis: Dorsal rays XIII, 14 + 9 finlets; anal rays 14 + 8 finlets; pectoral rays 34; gill rakers 8 + 21; body depth 3.89, head length 3.5 in FL. Pectoral fin very long, reaching well beyond second dorsal and anal fin. The body shape and colour of the freshly caught specimen is shown in Plate 4.

Remarks: This species is easily distinguished from its congeners by the length of its pectoral fins. *Thunnus alalunga* is a cosmopolitan species occurring world-wide between about 45-50°N and 30-40°S (COLLETTE 1986).

DISCUSSION

Compared with other marginal seas of the tropical Indian Ocean, the fish fauna of the Red Sea is very diverse. The ichthyogeography and the history of the colonisation of the Red Sea by Indo-Pacific fishes has been discussed in KLAUSEWITZ (1989). The narrow Strait of Perim is the only connection between the Red Sea and the Indian Ocean, and the Strait of Tiran separates the main basin from the Gulf of Aqaba. Despite these two barriers the fish fauna of the Gulf of Aqaba is very rich and although it has been the subject of many ichthyological studies, new fish records and undescribed species continue to be discovered along the Jordanian coast (e.g. SCHUHMACHER et al. 1989, KRUPP & PAULUS 1991).

We must assume that *Myripristis chryseres*, *Pterygotrigla hemisticta* and *Bodianus leucostictus* have a wide, though perhaps patchy distribution throughout the Red Sea. Many reef fishes in the Gulf of Aqaba occur at much shallower depths than their conspecifics in the central and southern Red Sea (KRUPP et al. 1993). This phenomenon, together with the fact that the central and southern areas are less well known, may explain why they have not yet been recorded further south.

Unlike the other three records presented here, *Thunnus alalunga* is an open water species occurring in subtropical and temperate seas in both hemispheres. Records closest to the Red Sea are off the eastern coast of Somalia and the Mediterranean. The specimen collected in the Gulf of Aqaba might well have entered the Red Sea through the Suez canal.

ACKNOWLEDGEMENTS

We would like to express our gratitude to Dr. Ahmad Abu-Hillal, Director of the Marine Science Station, Aqaba, for his support of our ichthyological studies. The staff of the MSSA, in particular Dr. Salim Almoghrabi and Mr. Omar Al-Momani, are gratefully acknowledged for their assistance. The Deanship of Academic Research, The University of Jordan, Amman, provided funds in support of this study.

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The Birds of Major Wadis in the Tihama Area South of Jeddah, Saudi Arabia

Hassan M. Felemban

Abstract: A systematic quantitative survey of the avifauna of four major wadis, Wadi Al-Lith, Wadi Ilyab, Wadi Nawan, and Wadi Al-Ahsaba, south of Jeddah, between Al-Lith (20°10'N 40°15'E) and Al-Qunfudah (19°15'N 41°05'E) was conducted on a monthly basis in 1988. In total 142 bird species were recorded. The occurrence and status of birds were classified into five categories: breeding residents, summer visitors, winter visitors, passage migrants, and mixed populations of residents and migrants. The similarities among different wadis are outlined based on species composition and numbers of individuals.

طيور الوديان الكبرى في منطقة تهامة جنوب جدة ، المملكة العربية السعودية

حسن. م. فلمبان

خلاصه : تم اجراء دراسة كمية شاملة شهرية خلال عام ١٩٨٨ على مجموعة الطيور في اربعة وديان كبرى هي : وادي الليث، وادي عليب، وادي ناوان، وادي الأحسبا جنوب جدة، بين الليث (٢٠°١٠' شمالاً و ٤٠°١٥' شرقاً) والقنفذة (١٩°١٥' شمالاً و ٤١°٠٥' شرقاً). وتمت تسجيل ١٤٢ نوعاً من الطيور وتم تحديد حالة وأماكن تواجد الطيور وصنفت في خمسة أقسام : طيور مقيمة متكاثرة، طيور زائرة صيفية، طيور زائرة شتوية، طيور مهاجرة عابرة، ومجموعات مختلطة من طيور مهاجرة ومقيمة. كما تم تبين أوجه التشابه بين الوديان المختلفة استناداً إلى تركيبة الأنواع وعدد الافراد.

INTRODUCTION

Although wadis are among the most remarkable and distinctive habitats in Arabia, comparatively little is known about their avifauna. LEES-SMITH (1986) analysed the composition of the bird communities of south-western Arabia, south of 20°N and west of 48°E; he suggested that, in an ornithological context, west of the escarpment at altitudes lower than 1800 m could be assigned to the Afrotropical region. The present study area lies below 700 m and is located at the northern limit of the tropical climatic zone and the extreme south-east of the Mediterranean climatic zone. Thus it has the influence of the north-easterly monsoon rains from March to August, and also winter rainfall. It tends to receive water in the form of floods which come from the highlands to the east of the study area rather than directly from rainfall.

The purpose of this study was to determine the occurrence of bird species through the year in each of the four wadis, since few other studies have monitored the avifauna in this habitat type on a monthly basis. However, studies in the Tihama of Yemen (BROOKS et al. 1987, SCHOLTE 1992) and in south-west Saudi Arabia (STAGG 1985, NEWTON et al. 1994, RAHMANI et al. 1994) have clarified the status and occurrence of several bird species in the area.

METHODS

This study was carried out from February to December 1988. The four wadis, Al-Lith, Ilyab, Nawan, and Al-Ahsaba, were visited in March, May, July, September and November, while Wadi Al-Lith and Wadi Ilyab were visited monthly. In total, each visit was of 2-3 days duration. During each visit a general survey of the bird species was made and the number of individuals was recorded. This was usually done from 06:00 to 10:00 h or midday. A four-wheel-drive vehicle was used to drive along about 10 km of suitable habitat in each wadi, east of the Jeddah-Al-Qunfudah main road.

Five categories were used for the status of bird species in this study: (1) Breeding resident: species which occurred within the study area or in adjacent sites during most of the year, with confirmed or suggested breeding records. (2) Summer visitor: species which arrived in early April to breed in the area and left in early September. (3) Winter visitor: species present in the area during November-March. (4) Passage migrant: species which occurred in the area in spring (primarily March-May) and/or autumn (primarily September-October) for a short period. (5) Mixed population: a category which included both migratory and resident individuals.

Species are listed systematically following the order of VOOUS (1973, 1977). The plant species are named according to MIGAHD (1978) and COLLENETTE (1985). Changes in bird species composition between months and between wadis were assessed by using suitable indices, following SOUTHWOOD (1978). The similarity of the composition of any two wadis was calculated from Jaccard's index of similarity:

$$CJ = j \times 100 / (a + b - j)$$

where (j) is the number of species common to the two samples and (a) and (b) are respectively the total number of species in each wadi.

Description of the study area

This study was conducted in Wadi Al-Lith, Wadi Ilyab, Wadi Nawan, and Wadi Al-Ahsaba, a relatively large area extending from 19°15'N to 20°10'N, and from 40°15'E to 41°15'E (Fig. 1). The study area is considered sub-tropical, in terms of latitude and plant cover distribution (ZAHARAN 1983). Approximately 10 km of the lower section of each wadi was studied, below an elevation of 700 m, just before their emergence from the foothills onto the coastal plain, but including upper sections wherever water was found.

The vegetation cover on the banks of the wadis is mainly dominated by Araak *Salvadora persica*. Other plant species which occur frequently include: the doum palm *Hyphaene thebaica*, *Acacia* spp., *Ziziphus* spp., *Tamarix* spp., *Phoenix dactylifera*, and *Calotropis procera*. All four wadis have similar plant cover, but both Wadi Nawan and Wadi Al-Ahsaba are surrounded by scattered agricultural areas. Water did not run perennially in Wadi Al-Ahsaba and Wadi Nawan, whereas Wadi Al-Lith and Wadi Ilyab had streams running during all months surveyed. In Wadi Al-Lith the presence of perennial water may be due to hot springs in the upper wadi. However, during the study period, the water never reached the Red Sea. The wadi bed is usually shallow and edged by reed swamp. KRUPP et al. (1990) have described Wadi Ilyab as a wide and sandy wadi with a very short watercourse, up to 2 m wide and 0.4 m deep, and Wadi Al-Ahsaba as a perennial watercourse, up to 4 m wide and 0.4 m deep, during March 1990. Thus, the upper reaches of many of the wadis of the Tihama coastal plain may have perennial water.

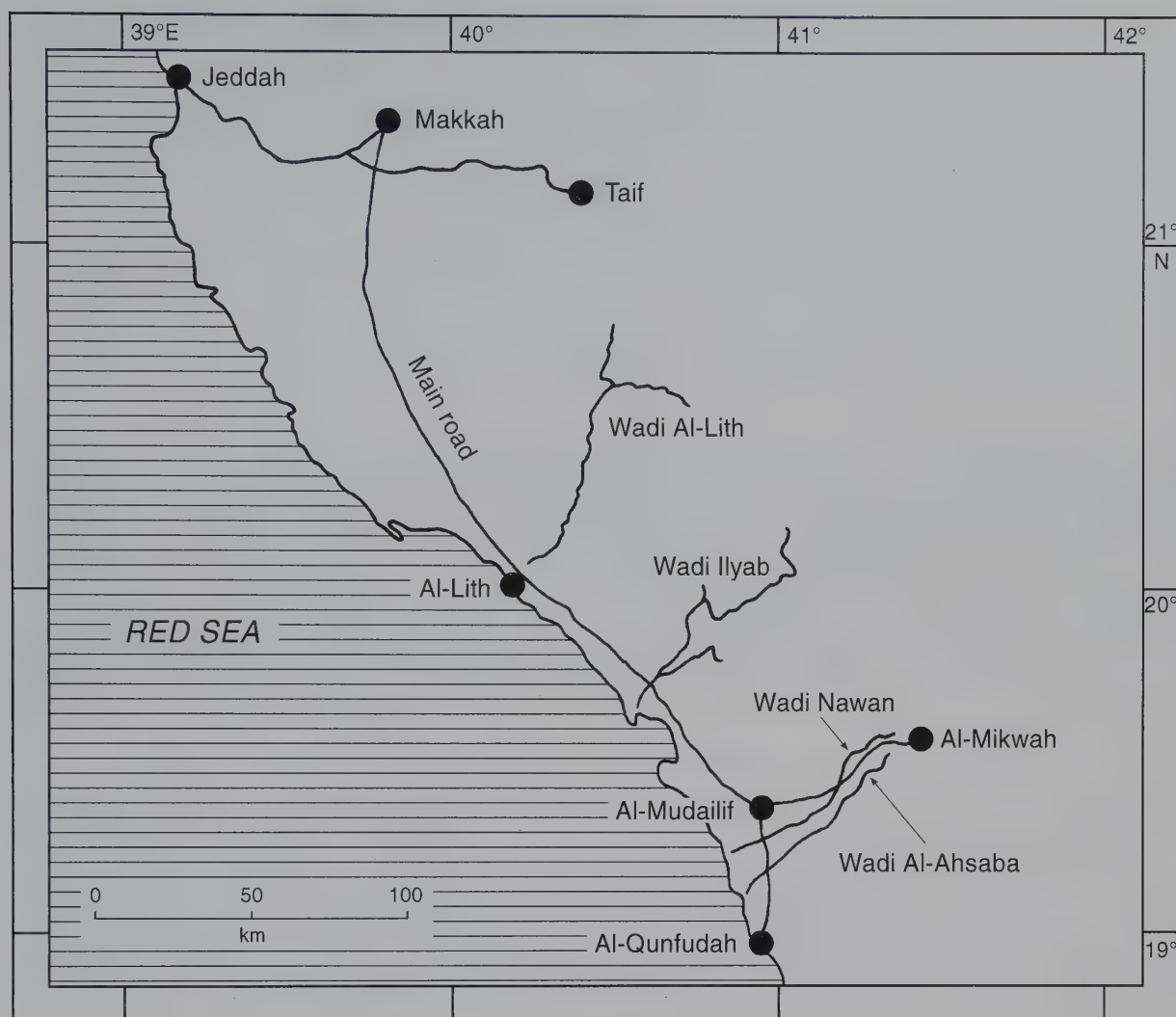


Fig. 1: Map of the study area showing the location of the four wadis surveyed during 1988.

Climate

High temperatures and low rainfall are the most important climatic features of the study area. The average annual precipitation of Al-Mudailif meteorological station (19°52'N 41°03'E) on the Tihama coastal plain was 55 mm, between 1979 and 1988 (Appendix I). The mean monthly temperature over the same ten year period was 25.7 °C in January and 33.0 °C in June.

RESULTS AND DISCUSSION

Species list and status

A total of 142 bird species has been recorded in the entire study area (Appendix II), although one (Arabian waxbill) was not seen during the actual study. Bird species were allocated to categories according to their presence and frequency, or absence, during different months of the year. Table 1

Table 1: Numbers of species of different status categories occurring in each month in 1988.

| Status category | Months (1988) | | | | | | | | | | | | Total | Grand total [%] |
|--------------------------------------------|---------------|----|----|----|----|----|----|----|----|----|----|-----|--------|--------------------|
| | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | | | |
| Breeding resident | 40 | 49 | 36 | 47 | 50 | 49 | 47 | 48 | 47 | 48 | 41 | 56 | 39.4 % | |
| Summer visitor | — | 2 | 3 | 3 | 3 | 3 | 3 | 3 | — | — | — | 3 | 2.1 % | |
| Winter visitor | 20 | 19 | 10 | 4 | — | — | 2 | 12 | 11 | 22 | 21 | 29 | 20.4 % | |
| Passage migrant | 2 | 20 | 18 | 10 | — | 1 | 8 | 25 | 26 | 12 | 5 | 49 | 34.5 % | |
| Mixed population (resident and migrant) | 4 | 5 | 5 | 5 | 5 | 5 | 4 | 5 | 5 | 5 | 5 | 5 | 3.5 % | |
| Totals | 66 | 95 | 72 | 69 | 58 | 58 | 64 | 93 | 89 | 87 | 72 | 142 | 100 % | |

shows that 56 of the total bird species recorded in this study were considered to be breeding residents (39.4 %), three species were summer visitors (2.1 %), 29 species were winter visitors (20.4 %), whereas passage migrants comprised 49 species (34.5 %), and a mixed population of residents and migrants totalled five species (3.5 %).

Amongst birds that were recorded as residents in this study, three species were previously stated by JENNINGS (1981) to be mainly migrants; little grebe, black-winged stilt, and spur-winged plover. However, HOLLOM et al. (1988) indicated that they have isolated breeding areas within the coastal plain of the Tihama.

The little grebe was observed only from Wadi Al-Lith during June to September and in December. It seems that this bird may remain within the study area, but it has not yet been proved to breed there. The black-winged stilt was present during all months. It has bred in small numbers in the Makkah sewage water drainage area (FELEMBAN & AL-BANNA 1993) and also near Jeddah (JENNINGS 1985). The spur-winged plover was observed regularly in Wadi Al-Lith and Wadi Ilyab in all months. JENNINGS (1981, 1985) indicated possible breeding of this bird in North Yemen and in Jeddah and HOLLOM et al. (1988) show several breeding records close to the study area.

Two species, the bateleur and the alpine swift, were seen in most months in the study area. JENNINGS (1981) indicated that they are locally resident in the Tihama, whereas HOLLOM et al. (1988) considered them as resident in south-western Arabia. Breeding within the study area may have occurred, since two juvenile bateleurs were observed with an adult female during March in Wadi Al-Lith, and large numbers of swifts were recorded from March to June.

The hamerkop is considered as a breeding resident in the area; birds were seen in the breeding season and an old nest was recorded in Wadi Ilyab.

The Arabian woodpecker and the Arabian golden sparrow were the only endemic species observed. The Arabian waxbill was not found during this work. The latter moves locally from low land to higher elevations (up to 2500 m) where it breeds. The most northerly sighting of the Arabian waxbill recorded by the author was from Taif (21°20'N 40°25'E) during March-July, and it was also recorded in Wadi Al-Khytan (19°40'N 41°45'E) in the foothills of the Tihama in January (FELEMBAN 1986).

Three species of summer visitors are believed to breed in the study area. The grey-headed kingfisher, the white-throated bee-eater and the gambage dusky flycatcher were present from April to August. Breeding of these three species was confirmed by FELEMBAN (1986) in Muhayil in the southern Tihama (18°32'N 42°01'E).

Fewer wintering species and individuals were noted than passage migrants (Tables 2 and 3). The number of individual passage migrants in spring (late March) was greater than in autumn

Table 2: Numbers of species of different status categories recorded in each wadi.

| Status Category | Wadi Al-Lith | Wadi Ilyab | Wadi Nawan | Wadi Al-Ahsaba | Grand total |
|--------------------------------------------|--------------|------------|------------|----------------|-------------|
| Breeding resident | 54 | 54 | 49 | 44 | 56 |
| Migrants (winter and passage) | 62 | 67 | 32 | 31 | 78 |
| Summer visitor | 3 | 3 | 2 | 3 | 3 |
| Mixed population (resident and migrant) | 5 | 5 | 4 | 4 | 5 |
| Totals | 124 | 129 | 87 | 82 | 142 |

(September). In June most migratory species were absent from the study area. Amongst 49 passage migrant species, 30 were known to be in transit for a short period of several days during spring and/or autumn. The other 19 species were recorded as passage migrants and winter visitors to the area (Appendix II).

A mixed population of resident and migrant birds was present all year round and included the following species: kestrel, Kentish plover, hoopoe, olivaceous warbler and masked shrike. Although they are probably residents, considerable numbers arrived in the study area to over-winter.

Similarities among wadis

Table 2 presents the total number of species occurring in the four wadis. Wadi Ilyab, with a total of 129 bird species, showed the highest diversity of species; Wadi Al-Ahsaba had the lowest diversity, with only 82 species. The highest numbers of resident bird species were observed in Wadi Al-Lith and Wadi Ilyab (Table 3). The fluctuation in resident species numbers is due to their local movements and seasonal habitat preference (FELEMBAN 1986). Both Wadi Nawan and Wadi Al-Ahsaba had fewer species (49 and 44 respectively) than the northern two wadis. Numbers of migrant bird species in Wadi Nawan and Wadi Al-Ahsaba were almost 50 % less than those of the other two wadis. It seems that migratory birds are attracted to running water habitats in arid environments.

The similarity among different wadis according to their species richness was assessed. Table 3 shows the total number of species and individuals for each wadi in each month, and the following can be concluded: a: The highest numbers of species (94) and individuals (717) for all wadis were recorded in March. b: The second highest number of species (92) for all wadis was in September. c: The second highest number of individuals (670) was in November. d: The least number of species (54) for all wadis was recorded in June. e: The least number of individuals (242) was recorded in July. f: The largest number of individuals was recorded in Wadi Ilyab in March (351). g: The smallest number of individuals was recorded in Wadi Nawan in July (46). h: The highest number of species (65) was recorded in Wadi Al-Lith in October; 58 species were recorded in Wadi Ilyab in September. The relatively small numbers of individuals is due to the absence of birds occurring in flocks and to low food availability. Because of bi-monthly visits to Wadis Nawan and Al-Ahsaba, it was only possible to examine the similarity in species and individual richness during March, May, July, September and November. Both Wadis Ilyab and Al-Lith have a greater variety of species than the other two wadis, which is due to the year-round presence of running water.

Table 3: Numbers of species and individuals recorded in four major wadis from February to December 1988.

| Month (1988) | | Wadi Al-Lith | Wadi Ilyab | Wadi Nawan | Wadi Al-Ahsaba | Grand Total |
|--------------|-------------|--------------|------------|------------|----------------|-------------|
| February | species | 44 | 35 | — | — | 65 |
| | individuals | 117 | 89 | — | — | 206 |
| March | species | 43 | 47 | 37 | 39 | 94 |
| | individuals | 160 | 351 | 102 | 104 | 717 |
| April | species | 47 | 51 | — | — | 72 |
| | individuals | 184 | 140 | — | — | 324 |
| May | species | 37 | 42 | 36 | 24 | 68 |
| | individuals | 90 | 100 | 111 | 86 | 387 |
| June | species | 35 | 41 | — | — | 55 |
| | individuals | 82 | 160 | — | — | 242 |
| July | species | 33 | 35 | 23 | 25 | 54 |
| | individuals | 79 | 100 | 46 | 81 | 306 |
| August | species | 41 | 35 | — | — | 60 |
| | individuals | 142 | 104 | — | — | 246 |
| September | species | 37 | 58 | 28 | 27 | 92 |
| | individuals | 221 | 223 | 77 | 76 | 597 |
| October | species | 65 | 51 | — | — | 89 |
| | individuals | 194 | 260 | — | — | 454 |
| November | species | 42 | 48 | 37 | 35 | 86 |
| | individuals | 178 | 191 | 154 | 147 | 670 |
| December | species | 53 | 47 | — | — | 70 |
| | individuals | 186 | 205 | — | — | 391 |

Table 4 shows the number of species in common between wadis. The proportions of species in common, the Jaccard similarity indices, can be calculated from figures shown in Table 4 as follows: a: The proportion of species common to Wadis Al-Lith and Ilyab is 79 % of all species recorded in both wadis. b: The proportion of species common to Wadis Al-Lith and Nawan is 60 % of all species recorded in both wadis. c: The proportion of species common to Wadis Al-Lith and Al-Ahsaba is 61 % of all species recorded in both wadis. d: The proportion of species common to Wadis Ilyab and Nawan is 63 % of all species recorded in both wadis. e: The proportion of species common to Wadis Ilyab and Al-Ahsaba is 60 % of all species recorded in both wadis. f: the proportion of species common to Wadis Nawan and Al-Ahsaba is 60 % of all species recorded in both wadis.

A nearest neighbour dendrogram can then be drawn (Fig. 2). The two most similar wadis (highest similarity indices) are placed on the apex line and joined at the level of their similarity index. Wadi Al-Lith and Wadi Ilyab are closely related to each other and have a high index of similarity (79), whereas Wadi Nawan and Wadi Al-Ahsaba have lower indices of similarity.

Table 4: Number of species common between wadis in the study area.

| | Wadi Al-Lith | Wadi Ilyab | Wadi Nawan | Wadi Al-Ahsaba |
|--------------|--------------|------------|------------|----------------|
| Wadi Al-Lith | — | 111 | 78 | 77 |
| Wadi Ilyab | | — | 82 | 78 |
| Wadi Nawan | | | — | 62 |

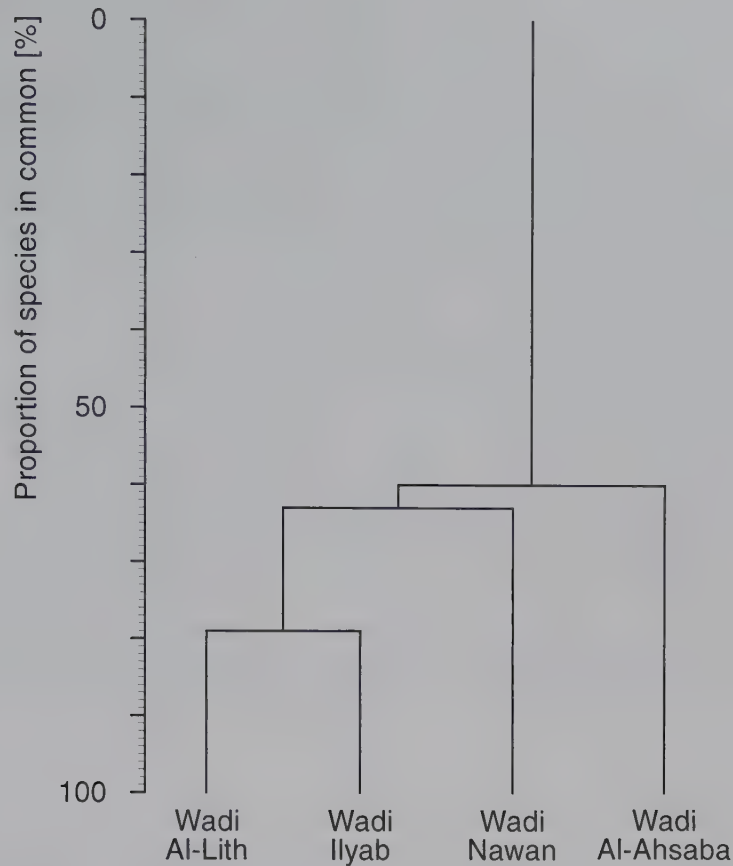


Fig. 2: A dendrogram of similarities among all wadis and all species.

In summary, this study may contribute to our understanding of the distribution of birds in major wadis systems in the Tihama region of south-western Saudi Arabia. SCHOLTE (1992) focused on the southernmost end of the Tihama wadi systems in his study of Wadi Rima in Yemen, whereas this study dealt largely with the northern parts of the Tihama within western Arabia. Therefore an additional study of areas in-between should be made in detail to complete the documentation of the avifauna of wadi systems in the Tihama of Saudi Arabia and Yemen.

ACKNOWLEDGEMENTS

I would like to express my thanks to the Scientific Research Council of King Abdul-Aziz University for providing funds to allow this project to continue.

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Appendix I

A: Monthly precipitation (mm) in Al-Mudailif Meteorological Station from 1979 to 1988.

Source: Ministry of Agriculture and Water, data for climatic water balance in Saudi Arabia.

| Month | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 |
|--------------|-------|------|------|------|------|------|------|------|------|------|
| January | 16.0 | 7.4 | 0 | 66.0 | 0 | 0 | 44.2 | 0 | 9.4 | 16.7 |
| February | 0 | 4.8 | 0 | 14.0 | 0 | 0 | 0 | 0 | 0 | 4.5 |
| March | 0 | 0 | 0 | 0.3 | 0.5 | 3.6 | 12.2 | 0 | 0 | 0 |
| April | 0 | 0 | 0 | 18.3 | 31.5 | 0.3 | 9.4 | 0 | 0.5 | 0 |
| May | 0 | 0 | 0 | 0 | 0 | 0.5 | 0 | 0 | 0 | 0 |
| June | 0 | 0 | 0 | 0 | 0 | 0.5 | 0 | 0 | 0 | 0 |
| July | 0 | 1.3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1.0 |
| August | 1.0 | 0 | 0 | 0 | 0 | 0 | 0 | 35.1 | 0 | 0 |
| September | 5.8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| October | 42.7 | 0 | 0 | 0 | 0 | 0 | 0 | 3.8 | 0 | 4.0 |
| November | 1.5 | 5.6 | 0 | 0 | 0 | 2.5 | 16.8 | 1.5 | 12.6 | 11.5 |
| December | 83.8 | 2.3 | 10.9 | 0 | 2.5 | 0 | 11.4 | 0.8 | 10.5 | 20.3 |
| Annual total | 150.8 | 21.3 | 10.9 | 98.6 | 34.5 | 7.4 | 94.0 | 41.1 | 33.0 | 58.0 |

B: Monthly Temperature (°C) in Al-Mudailif Meteorological Station from 1979 to 1988.

Source: Ministry of Agriculture and Water, data for climatic water balance in Saudi Arabia.

| Month | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | Mean |
|-----------|------|------|------|------|------|------|------|------|------|------|-------|
| January | 25.4 | 26.6 | 26.4 | 26.1 | 25.1 | 26.0 | 26.9 | 25.6 | 24.5 | 24.0 | 25.66 |
| February | 26.7 | 26.6 | 25.9 | 25.8 | 24.7 | 26.6 | 26.0 | 26.3 | 25.5 | 25.7 | 25.98 |
| March | 28.4 | 28.4 | 27.7 | 26.6 | 26.0 | 27.8 | 27.8 | 28.4 | 27.0 | 26.9 | 27.50 |
| April | 30.5 | 30.8 | 28.2 | 28.2 | 29.6 | 29.9 | 30.9 | 30.4 | 30.0 | 29.9 | 29.84 |
| May | 32.3 | 33.1 | 31.6 | 31.5 | 32.5 | 31.6 | 32.4 | 31.2 | 31.5 | 31.7 | 31.94 |
| June | 32.9 | 32.8 | 32.8 | 32.0 | 34.0 | 33.8 | 33.6 | 32.5 | 33.0 | 32.9 | 33.03 |
| July | 32.1 | 32.7 | 30.9 | 32.5 | 33.1 | 32.9 | 33.3 | 33.8 | 33.4 | 33.7 | 32.84 |
| August | 32.4 | 32.2 | 32.6 | 31.8 | 32.2 | 32.2 | 32.7 | 33.3 | 33.5 | 33.1 | 32.60 |
| September | 32.1 | 32.6 | 32.6 | 33.1 | 31.7 | 32.7 | 31.8 | 32.9 | 32.9 | 32.5 | 32.49 |
| October | 29.8 | 31.0 | 30.9 | 31.2 | 30.4 | 29.7 | 30.6 | 30.9 | 30.6 | 30.5 | 30.56 |
| November | 27.2 | 28.7 | 29.3 | 29.9 | 28.7 | 27.8 | 28.4 | 28.3 | 29.0 | 29.2 | 28.65 |
| December | 26.5 | 26.8 | 27.0 | 26.9 | 26.7 | 27.3 | 27.2 | 27.3 | 27.4 | 26.3 | 26.94 |

Appendix II

List of birds seen in the study area during 1988

Status: BR = breeding resident; WV = winter visitor; SV = summer visitor; PM = passage migrant; MX = mixed population of migrants and residents.

Abundance of species: R = rare, less than 10 records during this study; S = scarce, less than 10 records on a single day; C = common, regularly observed with daily counts of 10-100 birds; A = abundant, regularly observed with daily counts exceeding 100 birds.

| No. | Bird species | Wadi Al-Lith | Wadi Ilyab | Wadi Nawan | Wadi Al-Ahsaba | Status |
|-----|--------------------------------------------------------|-----------------|---------------|---------------|-------------------|--------|
| 1 | Little grebe (<i>Tachybaptus ruficollis</i>) | S | | | | BR |
| 2 | Pink-backed pelican (<i>Pelecanus rufescens</i>) | C | C | C | | BR |
| 3 | Bittern (<i>Botaurus stellaris</i>) | R | | | R | WV |
| 4 | Night heron (<i>Nycticorax nycticorax</i>) | R | R | | R | PM |
| 5 | Squacco heron (<i>Ardeola ralloides</i>) | C | C | C | C | PM+WV |
| 6 | Cattle egret (<i>Bubulcus ibis</i>) | C | C | C | C | BR |
| 7 | Little egret (<i>Egretta garzetta</i>) | C | C | S | S | WV |
| 8 | Grey heron (<i>Ardea cinerea</i>) | C | C | S | C | WV |
| 9 | Purple heron (<i>Ardea purpurea</i>) | | C | R | S | WV |
| 10 | Hamerkop (<i>Scopus umbretta</i>) | S | C | S | S | BR |
| 11 | Black stork (<i>Ciconia nigra</i>) | R | R | | | PM |
| 12 | Glossy ibis (<i>Plegadis falcinellus</i>) | C | C | C | | WV |
| 13 | Spoonbill (<i>Platalea leucorodia</i>) | C | C | | C | BR |
| 14 | Shelduck (<i>Tadorna tadorna</i>) | S | | | | WV |
| 15 | Wigeon (<i>Anas penelope</i>) | C | C | | | WV |
| 16 | Teal (<i>Anas crecca</i>) | A | A | | | WV |
| 17 | Mallard (<i>Anas platyrhynchos</i>) | C | A | | C | WV |
| 18 | Garganey (<i>Anas querquedula</i>) | A | A | | C | WV |
| 19 | Shoveler (<i>Anas clypeata</i>) | S | C | | S | WV+PM |
| 20 | Black kite (<i>Milvus migrans</i>) | C | C | C | C | BR |
| 21 | Egyptian vulture (<i>Neophron percnopterus</i>) | C | C | C | C | BR |
| 22 | Griffon vulture (<i>Gyps fulvus</i>) | S | S | S | | BR |
| 23 | Bateleur (<i>Terathopius ecaudatus</i>) | R | | | | WV+BR? |
| 24 | Marsh harrier (<i>Circus aeruginosus</i>) | S | S | S | | PM |
| 25 | Hen harrier (<i>Circus cyaneus</i>) | S | | | S | PM |
| 26 | Pallid harrier (<i>Circus macrourus</i>) | | S | S | | PM |
| 27 | Dark chanting goshawk (<i>Melierax metabates</i>) | S | S | S | C | BR |
| 28 | Buzzard (<i>Buteo buteo</i>) | S | R | R | R | PM |
| 29 | Steppe eagle (<i>Aquila nipalensis</i>) | C | C | | S | PM+WV |
| 30 | Osprey (<i>Pandion haliaetus</i>) | S | S | | | BR |
| 31 | Kestrel (<i>Falco tinnunculus</i>) | S | S | S | S | MX |
| 32 | Peregrine falcon (<i>Falco peregrinus</i>) | | R | | | PM |
| 33 | Moorhen (<i>Gallinula chloropus</i>) | S | S | | S | BR |
| 34 | Sand partridge (<i>Ammoperdix heyi</i>) | A | C | C | C | BR |
| 35 | Coot (<i>Fulica atra</i>) | S | C | | | WV |
| 36 | Demoiselle crane (<i>Anthropoides virgo</i>) | | R | | | PM |
| 37 | Houbara bustard (<i>Chlamydotis undulata</i>) | R | | | | PM |
| 38 | Black-winged stilt (<i>Himantopus himantopus</i>) | A | A | C | A | MX |
| 39 | Avocet (<i>Recurvirostra avosetta</i>) | S | | | | WV |
| 40 | Collared pratincole (<i>Glareola pratincola</i>) | | C | | | PM+WV |
| 41 | Black-winged pratincole (<i>Glareola nordmanni</i>) | C | C | | | PM |
| 42 | Little ringed plover (<i>Charadrius dubius</i>) | C | A | C | C | WV |
| 43 | Kentish plover (<i>Charadrius alexandrinus</i>) | C | C | C | C | MX |
| 44 | Greater sandplover (<i>Charadrius leschenaultii</i>) | C | C | | | WV+PM |

| No. | Bird species | Wadi Al-Lith | Wadi Ilyab | Wadi Nawan | Wadi Al-Ahsaba | Status |
|-----|---------------------------------------------------------------|-----------------|---------------|---------------|-------------------|--------|
| 45 | Caspian plover (<i>Charadrius asiaticus</i>) | C | C | C | | PM |
| 46 | Grey plover (<i>Pluvialis squatarola</i>) | C | C | C | C | WV+PM |
| 47 | Spur-winged plover (<i>Hoplopterus spinosus</i>) | C | C | C | | BR |
| 48 | White-tailed plover (<i>Chettusia leucura</i>) | R | S | | S | WV+PM |
| 49 | Sanderling (<i>Calidris alba</i>) | S | C | S | S | PM+WV |
| 50 | Little stint (<i>Calidris minuta</i>) | A | A | A | C | WV |
| 51 | Dunlin (<i>Calidris alpina</i>) | A | A | A | | WV+PM |
| 52 | Ruff (<i>Philomachus pugnax</i>) | S | C | | | WV |
| 53 | Common snipe (<i>Gallinago gallinago</i>) | | C | C | C | PM+WV |
| 54 | Redshank (<i>Tringa totanus</i>) | A | A | C | A | PM+WV |
| 55 | Greenshank (<i>Tringa nebularia</i>) | C | C | C | C | PM |
| 56 | White-winged black tern (<i>Chlidonias leucopterus</i>) | S | S | | | PM |
| 57 | Lichtenstein's sandgrouse (<i>Pterocles lichtensteinii</i>) | C | A | S | | BR |
| 58 | Chestnut-bellied sandgrouse (<i>Pterocles exustus</i>) | | C | C | | BR |
| 59 | Rock pigeon (<i>Columba livia</i>) | C | C | C | C | BR |
| 60 | African collared dove (<i>Streptopelia roseogrisea</i>) | A | C | A | C | BR |
| 61 | Turtle dove (<i>Streptopelia decaocto</i>) | A | A | | | PM |
| 62 | Palm dove (<i>Streptopelia senegalensis</i>) | C | C | C | C | BR |
| 63 | Namaqua dove (<i>Oena capensis</i>) | C | C | C | C | BR |
| 64 | African eagle owl (<i>Bubo africanus</i>) | R | | | R | BR |
| 65 | Little owl (<i>Athene noctua</i>) | S | R | S | | BR |
| 66 | Common swift (<i>Apus apus</i>) | A | C | C | C | PM |
| 67 | Alpine swift (<i>Apus melba</i>) | C | C | C | C | PM+BR? |
| 68 | House swift (<i>Apus affinis</i>) | C | C | C | C | BR |
| 69 | Palm swift (<i>Cypsiurus parvus</i>) | A | C | C | | BR |
| 70 | Grey-headed kingfisher (<i>Halcyon leucocephala</i>) | S | S | | | SV |
| 71 | White-throated bee-eater (<i>Merops albicollis</i>) | C | C | C | C | SV |
| 72 | Little green bee-eater (<i>Merops orientalis</i>) | C | C | C | C | BR |
| 73 | Blue-cheeked bee-eater (<i>Merops superciliosus</i>) | C | C | | | PM |
| 74 | European bee-eater (<i>Merops apiaster</i>) | A | A | | | PM |
| 75 | Abyssinian roller (<i>Coracias abyssinicus</i>) | | C | C | C | BR |
| 76 | Hoopoe (<i>Upupa epops</i>) | C | C | C | C | MX |
| 77 | Grey hornbill (<i>Tockus nasutus</i>) | C | C | S | C | BR |
| 78 | Arabian woodpecker (<i>Dendrocopos dora</i>) | R | R | R | | BR |
| 79 | Black-crowned finch lark (<i>Eremopterix nigriceps</i>) | C | C | A | C | BR |
| 80 | Desert lark (<i>Ammomanes deserti</i>) | C | C | | C | BR |
| 81 | Hoopoe lark (<i>Alaemon alaudipes</i>) | | C | | C | BR |
| 82 | Short-toed lark (<i>Calandrella brachydactyla</i>) | C | C | | C | WV |
| 83 | Crested lark (<i>Galerida cristata</i>) | C | C | C | C | BR |
| 84 | Pale crag martin (<i>Ptyonoprogne fuligula</i>) | C | C | C | C | BR |
| 85 | Crag martin (<i>Ptyonoprogne rupestris</i>) | C | C | | | PM |
| 86 | Swallow (<i>Hirundo rustica</i>) | A | A | A | | PM+WV |
| 87 | Red-rumped swallow (<i>Hirundo daurica</i>) | A | C | C | C | BR |
| 88 | Long-billed pipit (<i>Anthus similis</i>) | C | C | C | C | BR |
| 89 | Red-throated pipit (<i>Anthus cervinus</i>) | | S | | | BR |
| 90 | Yellow wagtail (<i>Motacilla flava</i>) | A | A | A | C | PM+WV |
| 91 | Grey wagtail (<i>Motacilla cinerea</i>) | C | C | S | C | PM |
| 92 | White wagtail (<i>Motacilla alba</i>) | A | A | A | A | WV |
| 93 | Black-capped bulbul (<i>Pycnonotus xanthopygos</i>) | C | C | C | C | BR |
| 94 | Rufous bush chat (<i>Cercotrichas galactotes</i>) | S | S | | C | PM+WV |
| 95 | Black bush chat (<i>Cercotrichas podobe</i>) | C | C | C | C | BR |
| 96 | Bluethroat (<i>Luscinia svecica</i>) | | S | | | PM |
| 97 | Redstart (<i>Phoenicurus phoenicurus</i>) | C | C | | | PM |
| 98 | Blackstart (<i>Cercomela melanura</i>) | C | C | C | C | BR |
| 99 | Stonechat (<i>Saxicola torquata</i>) | S | C | S | | WV+PM |

| No. | Bird species | Wadi Al-Lith | Wadi Ilyab | Wadi Nawan | Wadi Al-Ahsaba | Status |
|-----|-------------------------------------------------------------|-----------------|---------------|---------------|-------------------|--------|
| 100 | Isabelline wheatear (<i>Oenanthe isabellina</i>) | C | C | | C | WV |
| 101 | Wheatear (<i>Oenanthe oenanthe</i>) | C | C | C | C | PM |
| 102 | Black-eared wheatear (<i>Oenanthe hispanica</i>) | | S | | | PM |
| 103 | Desert wheatear (<i>Oenanthe deserti</i>) | C | | | | WV |
| 104 | Red-tailed wheatear (<i>Oenanthe xanthopyrma</i>) | | C | | | WV |
| 105 | Mourning wheatear (<i>Oenanthe lugens</i>) | C | | C | | WV |
| 106 | Graceful warbler (<i>Prinia gracilis</i>) | C | C | C | C | BR |
| 107 | Scrub warbler (<i>Scotocerca inquieta</i>) | | | S | | BR |
| 108 | Reed warbler (<i>Acrocephalus scirpaceus</i>) | C | C | | | PM |
| 109 | Great reed warbler (<i>Acrocephalus arundinaceus</i>) | | S | | | PM |
| 110 | Olivaceous warbler (<i>Hippolais pallida</i>) | C | C | C | | MX |
| 111 | Desert warbler (<i>Sylvia nana</i>) | C | | | S | WV |
| 112 | Arabian warbler (<i>Sylvia leucomelaena</i>) | C | C | C | C | BR |
| 113 | Barred warbler (<i>Sylvia nisoria</i>) | | C | S | | PM |
| 114 | Lesser whitethroat (<i>Sylvia curruca</i>) | C | C | C | C | PM+WV |
| 115 | Whitethroat (<i>Sylvia communis</i>) | C | C | | | PM |
| 116 | Blackcap (<i>Sylvia atricapilla</i>) | A | C | C | C | PM |
| 117 | Chiffchaff (<i>Phylloscopus collybita</i>) | C | C | C | C | PM+WV |
| 118 | Willow warbler (<i>Phylloscopus trochilus</i>) | C | C | C | | PM |
| 119 | Spotted flycatcher (<i>Muscicapa striata</i>) | S | C | | C | PM |
| 120 | Gambage dusky flycatcher (<i>Muscicapa gambagae</i>) | C | C | C | C | SV |
| 121 | Arabian babbler (<i>Turdoides squamiceps</i>) | C | C | C | C | BR |
| 122 | Nile valley sunbird (<i>Anthreptes metallicus</i>) | C | C | C | C | BR |
| 123 | Shining sunbird (<i>Nectarinia habessinica</i>) | C | C | C | C | BR |
| 124 | Orange-tufted sunbird (<i>Nectarinia osea</i>) | S | C | | | BR |
| 125 | Golden oriole (<i>Oriolus oriolus</i>) | C | C | | | PM |
| 126 | Bush shrike (<i>Tchagra senegala</i>) | R | R | | S | BR |
| 127 | Red-tailed shrike (<i>Lanius isabellinus</i>) | C | C | C | C | PM |
| 128 | Red-backed shrike (<i>Lanius collurio</i>) | C | C | C | | PM |
| 129 | Great grey shrike (<i>Lanius excubitor</i>) | C | C | C | C | BR |
| 130 | Woodchat shrike (<i>Lanius senator</i>) | S | C | | | PM |
| 131 | Masked shrike (<i>Lanius nubicus</i>) | C | C | C | C | PM+WV |
| 132 | Brown-necked raven (<i>Corvus ruficollis</i>) | C | C | C | C | BR |
| 133 | Fan-tailed raven (<i>Corvus rhipidurus</i>) | C | C | C | | BR |
| 134 | House sparrow (<i>Passer domesticus</i>) | A | A | C | A | BR |
| 135 | Arabian golden sparrow (<i>Passer euchlorus</i>) | C | A | | A | BR |
| 136 | Rüppell's weaver (<i>Ploceus galbula</i>) | A | C | C | A | BR |
| 137 | Arabian waxbill (<i>Estrilda rufibarba</i>) | | | C | | BR |
| 138 | African silverbill (<i>Euodice cantans</i>) | C | C | C | C | BR |
| 139 | House bunting (<i>Emberiza striolata</i>) | C | C | C | C | BR |
| 140 | Cinnamon-breasted rock bunting (<i>Emberiza tahapisi</i>) | C | C | C | C | BR |
| 141 | Ortolan bunting (<i>Emberiza hortulana</i>) | C | C | | | PM |
| 142 | Cretzschmar's bunting (<i>Emberiza caesia</i>) | | A | | | PM |

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

تقديم

لصاحب السمو الملكي الأمير سعود بن فيصل بن عبد العزيز
العضو المنتدب للهيئة

إن موقع الجزيرة العربية في ملتقى ثلاثة اقاليم حيوانيه وجغرافيه رئيسيه بالاضافه إلى تاريخها الجيولوجي الحديث والتنوع الكبير في مظاهرها ومناطقها الطبيعية ومناخها قد انعكس في تاريخها الطبيعي المعقد وخاصة في تنوع مجموعتها الحيوانيه الفطريه وراثتها رغم البيئة القاحلة التي تسود في معظمها. ولم تبدأ الدراسات التصنيفية للتنوع الاحيائي في الجزيرة العربية إلا منذ عقدين من الزمان حينما بدأ الدكتور ويليام بوتيكور المسح الحيواني للجزيرة العربية مثيراً بذلك عدداً كبيراً من الانشطة البحثيه الاحيائيه في المنطقه التي كانت مجموعتها الحيوانيه الفطريه من أقل المجموعات المعروفة في العالم. وسرعان ما تجمعت ثروه كبيره من المعلومات العلميه الاساسيه عن تصنيف المجموعه الحيوانيه فيها وانتشارها وتوزيعها الجغرافي وايكولوجيتها وكلها كانت معلومات ضروريه للاستخدام المستدام للموارد الطبيعيه المتجدده في الجزيرة العربية وللمحافظة على الحياة الفطرية فيها.

والمحافظة على الطبيعه في الجزيره العربيه هو تقليد قديم لان مفهوم الإسلام عن البيئة يتبع مقترباً ايكولوجياً شاملاً. فهو يحدد بوضوح العلاقة التي يجب ان تقوم بين الإنسان وبيئته وتفاعلهما معاً فيما يخص التنميه واستخدام الموارد الطبيعيه المتجدده والمحافظة عليها. ومع التسارع المتزايد ابدأ للتنميه الحديثه فقد اخذت الموارد الطبيعيه مثل المياه واراضي المراعي والغابات والاحياء الفطريه تصبح اكثر ندره. وفي ضوء ذلك فإن المؤسسات التقليديه مثل الحمى، وهو الصوره التقليديه القديمه للمناطق المحميّه، يكتسب تطبيقات جديده خلاقه تشكل مع نتائج الابحاث الحيوانيه الحديثه اساس المفهوم المحلي للتنميه المستدامه والمحافظة على الموارد الطبيعيه.

وقد كانت سلسله مجلدات المجموعه الحيوانيه للمملكه العربيه السعوديه عاملاً أساسياً في تحقيق هذه الاهداف طيلة الستة عشر عاماً التي مضت منذ بداية صدورها. ومع ظهور المجلد الخامس عشر من المجموعه حدث منعطف جديد إذ قرر الدكتور بوتيكور، الذي اسس المجموعه عام ١٩٧٩م وكان هو المحور الاول لها منذ ذلك التاريخ، ان يتخلى عن موقعه لزملاء من شباب العلماء. ويسرني باسم الهيئه الوطنيه لحماية الحياة الفطرية وإنمائها ان اعبر عن بالغ امتناني للدكتور بوتيكور وعميق احترامي لمساهماته البارزه في دراسة الحياه الفطريه العربيه ووضع اسس المحافظه عليها، متمنياً للفريق الجديد الذي اخذ على عاتقه مهمه تحرير السلسله النجاح والتوفيق في مواجهه التحدي ومتطلبات العمل للسير بنجاح في خطى الدكتور ويليام بوتيكور.

سعود الفيصل

المشرف العام

صاحب السمو الملكي الأمير سعود الفيصل ، العضو المنتدب للهيئة الوطنية لحماية الحياة الفطرية وإنمائها، الرياض ، المملكة العربية السعودية .

مستشارو هيئة التحرير

الأستاذ الدكتور عبد العزيز حامد أبو زنادة ، الأمين العام للهيئة الوطنية لحماية الحياة الفطرية وإنمائها ، الرياض ، المملكة العربية السعودية .
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اللجنة الاستشارية

الأستاذ الدكتور محمد الخليفة ، كلية العلوم ، جامعة الملك سعود ، الرياض ، المملكة العربية السعودية .
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الدكتور و. بومة ، معهد أبحاث علم الحيوان ومتحف الكسندر كونينغ ، بون ، ألمانيا .
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الأستاذ الدكتور هـ.ج. دومنت ، جامعة جنت الحكومية ، جنت ، بلجيكا .
السيد م.د. جالاهر ، وزارة التراث القومي والثقافة ، مسقط ، سلطنة عُمان .
الدكتور د.ل. هاريسون ، متحف هاريسون لعلم الحيوان ، سفن أوكس ، المملكة المتحدة .
الأستاذ الدكتور منصور فارس حسين ، كلية الزراعة ، جامعة الملك سعود ، الرياض ، المملكة العربية السعودية .
الأستاذ الدكتور ر. كنزلباخ ، الجامعة التكنولوجية ، دارمشتاد ، ألمانيا .
الدكتور د.كوك ، معهد أبحاث سنكنبرج ، فرانكفورت ، ألمانيا .
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الدكتور عبد الرشيد نواب ، ارامكو ، الظهران ، المملكة العربية السعودية .
السيد أ. بونت ، متحف الجامعة ، اكسفورد ، المملكة المتحدة .
الدكتور أ.ر.ج. برايس ، جامعة واريك ، المملكة المتحدة .
السيد ج.ب. بويوف ، معهد الموارد الطبيعية ، كاثام ، المملكة المتحدة .
الدكتور ج.اى. راندال ، متحف بيشوب ، هونولولو ، جزر هاواي ، الولايات المتحدة الأمريكية .
الدكتور و. شنايدر ، متحف دارمشتاد ، دارمشتاد ، ألمانيا .
الدكتور سى.ر. سى. شيبارد ، الجامعة ، واريك ، المملكة المتحدة .
الأستاذ الدكتور عبد المنعم تلحوق ، الجامعة الأمريكية ، بيروت ، الجمهورية اللبنانية .

المحرران

الدكتور فريدهلم كروب ، محمية الجبيل للأحياء البحرية ، ص.ب. ١١٠٧١ ، الجبيل ، المملكة العربية السعودية .
الدكتور فلكر مانرت ، متحف التاريخ الطبيعي ، جنيف ، سويسرا .

المحرر المؤسس

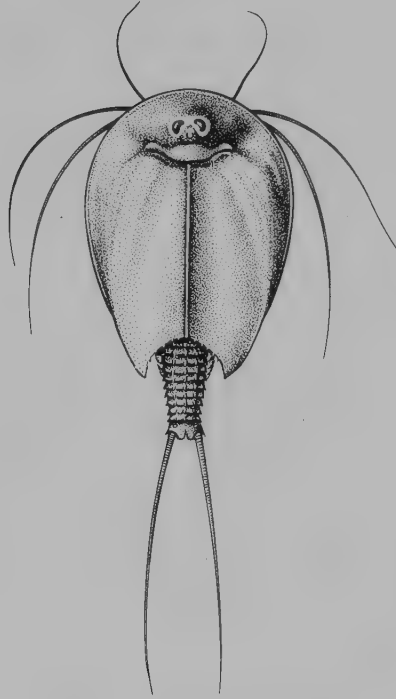
الأستاذ الدكتور وليم بوتيكير ، ماجدن ، سويسرا .

المجموعة الحيوانية

في

المملكة العربية السعودية

المجلد الخامس عشر ١٩٩٦



Triops cancriformis (Bosc, 1801)

المشرف العام

صاحب السمو الملكي الأمير سعود الفيصل

المحرران

فلكر مانرت

فريدهلم كروب

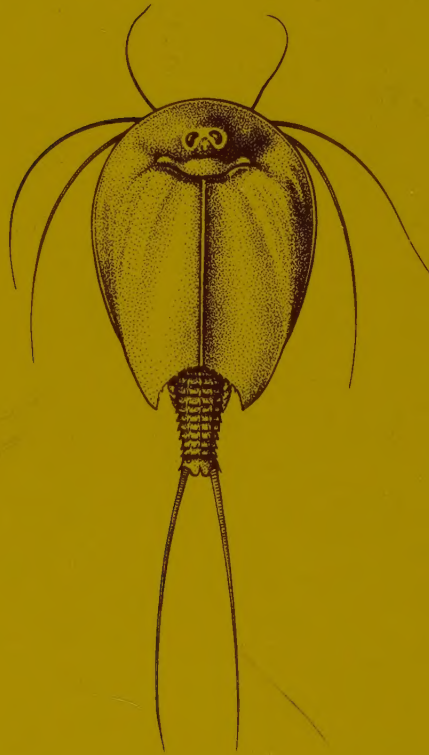
الهيئة الوطنية لحماية الحياة الفطرية وإنمائها ، الرياض ، المملكة العربية السعودية
برو انتمولوجيا ، متحف التاريخ الطبيعي ، بازل ، سويسرا

المجموعة الحيوانية

في

المملكة العربية السعودية

المجلد الخامس عشر ١٩٩٦



المشرف العام

صاحب السمو الملكي الأمير سعود الفيصل

المحرران

فلكر مانرت

فريدهلم كروب

الهيئة الوطنية لحماية الحياة الفطرية وإنمائها ، الرياض ، المملكة العربية السعودية

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